

**Original citation:**

Heredia Pérez, Jorge A., Geldes, Cristian, Kunc, Martin and Flores, Alejandro (2018) New approach to the innovation process in emerging economies : the manufacturing sector case in Chile and Peru. Technovation . doi:10.1016/j.technovation.2018.02.012

**Permanent WRAP URL:**

<http://wrap.warwick.ac.uk/101470>

**Copyright and reuse:**

The Warwick Research Archive Portal (WRAP) makes this work by researchers of the University of Warwick available open access under the following conditions. Copyright © and all moral rights to the version of the paper presented here belong to the individual author(s) and/or other copyright owners. To the extent reasonable and practicable the material made available in WRAP has been checked for eligibility before being made available.

Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge. Provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.

**Publisher's statement:**

© 2018, Elsevier. Licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International <http://creativecommons.org/licenses/by-nc-nd/4.0/>

**A note on versions:**

The version presented here may differ from the published version or, version of record, if you wish to cite this item you are advised to consult the publisher's version. Please see the 'permanent WRAP url' above for details on accessing the published version and note that access may require a subscription.

For more information, please contact the WRAP Team at: [wrap@warwick.ac.uk](mailto:wrap@warwick.ac.uk)

# **New approach to the innovation process in emerging economies: The manufacturing sector case in Chile and Peru**

Jorge A. Heredia Pérez<sup>a,\*</sup>, Cristian Geldes<sup>b</sup>, Martin H. Kunc<sup>c</sup>, Alejandro Flores<sup>a</sup>

<sup>a</sup> Business School, Universidad del Pacífico, Calle Sanchez Cerro 2141, Jesús María, Lima 11, Peru

<sup>b</sup> Faculty of Economy and Business, Universidad Alberto Hurtado, Santiago, Chile

<sup>c</sup> Warwick Business School, The University of Warwick, CV4 7AL Coventry, UK

---

## **Abstract**

This paper focuses on paths towards innovation and considers different types of innovation. It develops a new framework to analyze the internal and external factors that influence the types of innovation and their relationships with business performance in the manufacturing sector. A proposed theoretical model is tested and used to evaluate the process of innovation by country (Peru and Chile) and companies by size, type of industry, financial aspects and level of patenting. In Chile, the driver is technological innovation in processes, whereas in Peru, it is non-technological innovation. Companies with high perceptions of financial constraints exhibit a preference for the development of marketing innovations to substantially improve production performance; if a company perceives few financial barriers, it increases innovation resources and process innovation to significantly improve market performance. Small businesses increase non-technological innovation by investing in staff to manage the social networks. Moreover, the participation of foreign capital may overcome the institutional voids and lack of support systems. Furthermore, the combination of process and organizational innovation increases export performance, and the effect of the cooperation depends on the type of industry. Finally, we note the limitations and propose future research.

**Keywords:** innovation, business performance, financial barrier, innovation process.

## **1.- Introduction**

The business innovation-related literature is extensive, including approaches at the firm, industry and regional levels (Porter, 1998; Lazonick, 2005; Cooke, 2008; Damanpour et al., 2009; Feldman and Kogler, 2010; McCann and Ortega-Argiles, 2015). However, most studies have focused on developed economies, with less emphasis on emerging markets, such as Latin America, which has only been investigated according to isolation R&D, innovative performance and profit of the firm; thus, there is a gap in the systematic investigation of the process of innovation in emerging economies (Becheikh et al. 2006; Bogliacino et al., 2012; Geldes et al., 2017a).

The study of innovation in Latin America was initiated late. Ketelhöhn and Ogliastri (2013) summarized the literature for innovation and entrepreneurship in Latin America and indicated that most articles were focused on marketing innovation rather than innovation activities. This is partially reflected in the statistics, which indicate that the economic weight of the innovative activity in the region is disproportionately low (Bas et al., 2008; Bas and Kunc, 2009; Olavarrieta and Villena, 2014). For example, for the period 2008-2012, only 0.19% of patents registered in the United States Patent and Trademark Office originated from Latin American companies despite the finding that the region accounts for approximately 10% of the global Gross Domestic Product (GDP) (United State Patent and Trademark Office -USPTO, 2014). However, innovation efforts in Chile and Peru have increased in recent years. The Production Promotion Corporation - CORFO (Chilean Economic Development Agency) has doubled its budget to develop innovation projects (CORFO, 2013). These same efforts have been implemented in Peru through the National Council

for Science, Technology and Technological Innovation – CONCYTEC, which tripled the budget to develop innovative projects (CONCYTEC, 2013). These efforts by the governments of Chile and Peru are reflected in the increase in R&D spending per capita between 2011 and 2015, from \$42.19 to \$51.57 in Chile and from \$4.77 to \$7.12 in Peru (Red de Indicadores de Ciencia y Tecnología - RICYT, 2017). In Latin America, the industrial sector of mining, construction, electricity, water and manufacturing has accounted for more than one-third of the GDP in each country. The GDP structures in Chile and Peru are similar, as evidenced by the finding that, the service sector accounts for more than half of each country's GDP, whereas the share of the manufacturing sector in GDP declined from 19% in Chile and 17% in Peru in 2000, to 12% and 14% in 2015, respectively (World Bank, 2017). However, one of the primary reasons for choosing the manufacturing industry is its high relevance to job creation. Approximately 903,700 jobs were created by Chilean firms engaged in manufacturing in 2016, representing 11% of the total number of jobs created (Ministerio del Trabajo y Previsión Social, 2017). The same year, 510,000 jobs were created by Peruvian manufacturing firms, accounting for 17% of the country's total (Ministerio del Trabajo y Promoción del Empleo, 2017). In both countries, the manufacturing industry is surpassed only by the commercial sector in terms of job generation. Furthermore, if we analyze a recent statistical report, external factors, for example, the price of minerals, have similarly affected manufacturing growth in Peru and Chile for the previous 10 years (Instituto Nacional de Estadísticas- INE, 2016). However, the behavior by country is different. For example, the level of inter-firm cooperation in Peru is greater than in Chile (Schwellnus, 2010; Nieto and Santamaría, 2010). This point is important in evaluating the innovation process by country if the goal is to determine how the paths of the innovation process change within the context of each country and each industrial sector (Becheikh et al., 2006; Bogliacino et al., 2012; Geldes et al., 2017a).

The grade of paths change deepens the investigation of the innovation process and highlights the industry and strategic perspectives. From the perspective of the industry, the innovation process comprises a complex system with lags and feedback loops that leads to the evolution of innovation in positive economic cycles (Guarascio et al., 2015). For example, the investment in R&D has a significant effect on the innovation results and the profit of the sector, which subsequently affect future efforts in R&D and the innovation capacity; this is referred to as the “circular model” of the innovation process (Bogliacino and Pianta, 2013). However, under negative economic cycles, the results of innovation do not increase the performance of the sector, and the feedback effect decreases on the inputs of the innovation (Guarascio et al., 2015). This circular model has been extended to the company level by verifying the dynamic relation between the expenditures in innovation, sales from new products, and economic results, which influence future inputs of the innovation process (Bogliacino et al., 2015). Therefore, to understand the innovation process over time, it is necessary to consider positive and negative feedback loops between internal variables, external variables and different stakeholders (Gary *et al.*, 2008, Kazakov and Kunc, 2016). More importantly, in the case of companies in emerging economies, institutions, resources and capabilities (Stock et al., 2002) are also relevant in the strategic process and performance of the firm (Parnell, 2011; Meyer and Peng, 2015) .

From the strategic perspective of innovation, there are numerous factors (internal and external) that influence the strategic process of innovation at the firm level for the substantial variability in performance between firms in a sector (Rumelt, 1991; Schendel and Channon, 1991; Ray et al., 2004; Meyer and Peng, 2015; Geldes et al., 2017a). In an analysis of the antecedents of innovation, it is necessary to identify significant explanatory variables that determine innovative behavior. Based on a systematic review of empirical articles, Becheikh et al. (2006) emphasize the need for an integrative framework to provide a comprehensive and coherent characterization of the state of

knowledge in this field. First, innovation depends on factors both internal and external to companies (Becheikh, Landry, and Amara 2006, Pavitt, 2009). The primary internal factors include the company size, organizational structure, resources available for innovation, team management, and active and functional strategies (Amara et al., 2010, Zhu, Wittmann, and Peng, 2012, Ketelhöhn and Ogliastri, 2013). Specifically, in case of the effect of enterprise size on innovation, existing studies produced mixed results due to different approaches being used. From the static perspective, large companies invest more in R&D and innovation. However, from the dynamic perspective, small enterprises can develop capabilities that improve R&D effectiveness through innovation, possibly even outperforming large enterprises (Cohen and Klepper, 1996; Becheikh, Landry and Amara, 2006; Stock, Greis and Fischer 2002). According to Dosi (1988), the relationship between the company size and R&D results is not linear, and can even be inverted. Another aspect involves such external factors as variations by sector or industry and among regions of the same country, unequal effects of government policies, business networks and knowledge acquisition (Pavitt 2009, Crossan and Apaydin, 2010). According to the Oslo Manual, which includes the recommendations of the Bogotá Manual for developing countries (Crespi and Peirano, 2007), innovation types (OECD/Eurostat, 2005) may be classified in technological (products and processes) and non-technological innovation (organizational and marketing) categories. These innovation types subsequently act as drivers to connect the resources and capabilities of the company to achieve competitive advantages (Parnell, 2002). Adequate theories are needed to understand the innovation process in general (Bogliacino et al., 2015, Bogliacino and Pianta, 2013), particularly in emerging economies (Zhu et al., 2012; Becheikh et al., 2006; Bogliacino et al., 2015), given that the majority of the studies analyze only isolated cases that consider a group of internal and external factors and provide less importance to non-technological innovation (Geldes and Felzensztein, 2013; ; Pino et al., 2016; Geldes et al., 2017a). Our study uses the business

performance measurements proposed by Venkatraman and Ramanujam (1986) to incorporate financial and operating indicators into measurements of business performance.

The implementation of innovation also requires managers to confront and overcome barriers. These barriers have different origins; however, the most important include financial (e.g., cost, risk funding), organizational (e.g., rigidity, centralization), informational (e.g., market and technology information), and other factors (Kühl and da Cunha, 2013; Bogliacino et al., 2009). The set of barriers may be extensive, depending on the context. Our approach is to focus on financial obstacles. In recent years, values of the Global Innovation Index (Cornell University, INSEAD & WIPO, 2017) indicate the existence of barriers to innovation in Peru and Chile. According to the index, Chile presents greater financial barriers than Peru. In the category of “Ease of Getting Credit,” Chile received a score of 50/100 compared to Peru’s 80/100 during 2015 - 2017. Even though credit in Peru was more accessible, financial constraints continued hampering innovation in both countries. Given the previously discussed issues, we propose a theoretical framework to explain the phenomenon of the innovation process, as well as to recognize different paths to activating each type of innovation in manufacturing companies within emerging economies (Becheikh et al., 2006; Geldes et al., 2017a). An empirical application of the theoretical model analyzes the manufacturing industries in Peru and Chile. Thus, the following research questions were posed: i) What types of internal and external factors affect each type of innovation in enterprises in the manufacturing sector in Latin America?, ii) What is the relationship between innovation types and business performance in manufacturing sector enterprises in Latin America?, iii) How do barriers affect the path to innovation in emerging economies?, and iv) How does the path to innovation change taking into account the characteristics of the company?. This study presents the following sections: a literature review; hypotheses; a methodological approach to

estimating the structural equation model; results; discussion; conclusions and limitations; and future research.

## **2.- Literature review and hypothesis**

The framework of this study aims to explain the strategic behavior of companies (Peng et al., 2009; Zhu et al., 2012). The majority of research is limited to investigations of the effects of external relations on company performance and fails to propose a comprehensive model (Chang et al., 2012). Previous studies have analyzed isolated factors that influence the ability to innovate and how each factor, individually, impacts a company's capacity to innovate (Ketelhöhn and Ogliastri, 2013; Zhu et al., 2012). This approach limits the understanding of how different factors may simultaneously, directly or indirectly, influence performance and generates limited conclusions with regard to the phenomenon of the innovation process (Chadee and Roxas, 2013; Yen, 2013; Becheikh et al., 2006).

In an analysis of the history of innovation surveys in Latin America, following the first application of the innovation surveys with the Oslo Manual, the need to expand the concept of R&D for developing economies was detected because of the differences identified compared with developed countries. These differences are as follows: informal organizational settings for conducting innovation, fewer R&D projects undertaken, innovation mainly based on the acquisition of technology embodied in capital equipment, the importance of organizational change in the innovation processes, fewer resources devoted to innovation activities, and fragmented flows of information within national systems of innovation; these differences gave rise to the Bogotá Manual, which served to complement the Oslo Manual, and the 2005 version includes an annex for less developed economies (Crespi and Peirano, 2007).

An important point to consider is the ambiguous use of the terms “innovation capability”, “technological innovation” and “innovation types”. This may be a result of the finding that



innovation may be viewed as a process influenced by factors that are external or internal to a company (Becheikh et al., 2006; Crossan and Apaydin, 2010). Currently, there are many definitions and typologies of innovation (Rowley et al., 2011; Geldes and Felzensztein, 2013; Geldes et al., 2017a). However, there is a consensus regarding the validity of the definition proposed by the Oslo Manual (OECD/Eurostat, 2005; Schmidt and Rammer, 2007; Mothe and Nguyen-Thi, 2012), which identifies four types of grouped innovations in terms of technological innovation (process and product) and non-technological innovation (marketing and organizational) (Tavassoli and Karlsson, 2015; Geldes et al., 2017b).

Various theories have been proposed to identify factors affecting the firm's approach to strategic innovation. Nelson and Winter (1982) lay out the foundation of evolutionary economic theory that explains the innovation process both at single firm and industry levels. The theory regards changes in product development processes or in company's internal procedures as innovation. Similarly, Dosi (1988) applies the theoretical perspective of evolution to explain varying approaches to innovation, adopted by industrial sectors grouped according to Pavitt taxonomy (Pavitt, 1984). The study utilizes the strategic tripod approach, because it includes and analyzes institutional aspects that interact with internal factors and the industry as a whole during the process of innovation at the firm level (Peng et al., 2009, Zhu, Wittmann, and Peng, 2012, Parnell, 2002). This approach has three legs, including (i) Institutional-based, which is referred to as the "rules of the game" (Peng et al., 2009; Olavarrieta and Villena, 2014), (ii) Resource-based, which posits that the specific capabilities of firms differentiate successful firms from failing firms, and (iii) Industry-based, which suggests that strategy tasks are mainly to stake out a position that is less vulnerable relative to the five forces of industry (Porter, 1998). Based on the strategic tripod view, the phenomenon of innovation-like strategy in emerging economies may be analyzed. In this case, we consider the

typologies of innovation strategies because innovation strategy generates competitive advantages (Parnell, 2002).

Regarding institutional factors that influence the decision to innovate at the company level, we analyze two elements of institutional factors: public government programs and the support system. Wei and Liu (2015) indicate that public government programs in the form of direct subsidies in R&D and regional innovation policies have positive effects on innovation performance. Furthermore, funding projects at the stage of R&D have positive effects on performance. However, project success depends more on trade conditions and lending rather than project selection criteria (Svensson, 2008). Moreover, Zhu et al. (2012) suggest five dimensions to explain factors that limit the potential for innovation and indicate a formal institutional constraint that has an impact on strategic decisions and is expected to adversely affect innovation and performance. Feldens et al., (2012), who investigated the Brazilian case, determined that a lack of skilled labor is an impediment to innovation. In summary, institutional factors, including insufficient information on technology, markets and infrastructure, are integrated in the support systems in a way that reflects the construct posed by Zhu et al. (2012). Based on these results, the following hypothesis is proposed.

***H1a:*** *The institutional factor (Support system) is negatively related to the innovation types (product/process/organization/marketing).*

***H1b:*** *The institutional factor (Public programs) is positively related to the innovation types (product/process/organization/marketing).*

Moreover, Tu et al. (2014) emphasize that a company's external relations, such as cooperation and use of external information sources, influence their ability to innovate. For example, cooperation decreases the risk of innovative activity (Morales and Sifontes, 2014). Furthermore, several authors have identified types of cooperation with suppliers, customers and competitors, universities, institutes, service providers of business development and central and local governments (Becheikh et al., 2006; de Faria et al., 2010; Zeng et al., 2010; Najib and Kiminami, 2011; Grimpe and Hussinger, 2013; Petruzzelli and Rotolo, 2015). In particular, Grimpe and Hussinger (2013), demonstrated that formal (contract-based) and informal (not involving a contractual relationship) university technology transfers are complementary. Formal technology transfers of knowledge, codified in a licensed patent, need to be supplemented by informal technology transfers of the implicit knowledge underlying the patent to enable a proper implementation within the firm that will increase the marginal return from formal technology transfers. Moreover, Morales and Sifontes (2014) analyzed nine Latin American countries and concluded that cooperation enables firms to increase technological innovation because it allows cooperative exchanges of skills. Similar results are obtained in China and India, where the effect of innovation increases when collaboration is involved and is even greater when collaboration is among countries with advanced technologies (Pai, Tseng, and Liou, 2012). Additionally, Geldeset al., (2017b) state that inter-firm cooperation is related positively, though not identically, to technological (0,21) and non-technological innovations (0,11) in the agricultural sector in Chile. The preceding arguments serve to support the following hypothesis.

***H2:***      *Cooperation is positively related to innovation types (product/process/organization/marketing).*

The exchange of information enables more innovation types to be efficiently combined, which facilitates a rapid response to market demand (Morales and Sifontes, 2014). Along these lines, Bala Subrahmanya (2013) suggests that internal skills facilitate the identification of external information absorption and improve performance. Furthermore, Robinson and Stubberud (2011) examine the aspect of acquiring knowledge of absorption capacities by analyzing sources of information that are considered highly important for innovation. Recent studies regarding the influence of information shared between suppliers and manufacturing companies in China indicate that there is a direct and positive effect between the characteristics of information and the innovative performance of manufacturing companies. Furthermore, operational improvements may be achieved using this information to process innovations (Xiaorong et al., 2013).

***H3: Sources of information are positively related to innovation types (product/process/organization/marketing).***

The term innovation capacity (resource for innovation) has been used from different perspectives. Martinez-Roman et al., (2011) posed a basic model for innovative capacity and focused their analysis on economies with R&D activity and a high number of non-technological firms; they recognize innovative capacity in three dimensions: (i) knowledge, (ii) organization and (iii) the human factor. The knowledge dimension includes research and development. Catozzella and Vivarelli (2014) indicate that internal R&D acts as an input to the innovation process (Becheikh et al., 2006), and R&D is a catalyst that accelerates “reactions” within an innovative process by improving the individual qualities of the resources it interacts with or creating absorptive capacity. Furthermore, R&D is useful in the process to develop new products and manufacturing processes.

Raymond and St-Pierre (2010) demonstrated that R&D had a positive effect on technological innovation. However, these authors recommend using non-technological innovations in the analysis of future studies (Raymond and St-Pierre, 2010). Another factor is the human dimension, which includes the educational level of workers (Yuqian and Dayuan, 2015). For example, a study in Brazil by Santos et al., (2014) indicates that the human factor has a significant effect on the performance of innovation. From another perspective, Lawson and Samson (2001) present a holistic approach that focuses on organizational aspects, climate, culture and management. It is important to note that this study recognizes the resources for innovation as an approximation to innovative capacities as suggested by Martinez-Roman et al. (2011). In summary, the literature presents a positive and significant relationship between the capacity for innovation and innovation types. This review enables us to suggest the following hypothesis:

***H4: The resources for innovation (R&D/human capital) are positively related to innovation types (product/process/organization/marketing).***

These hypotheses are based on the strategic tripod of Peng et al. (2009). Previous hypotheses have included the firm effect and institutional effect (two elements of tripod). Regarding the effect of industry, based on Peng et al. (2009), this factor affects the strategic decision to innovate. Furthermore, Powell (1996) characterizes this effect in terms of the intensity with which it impacts competition, industry concentration and growth in demand.

***H5: The industry effect is positively related to the innovation types (product/process/organization/marketing).***

For innovation types, previous studies have presented different classifications. For example, a radical and incremental innovation classification, which categorizes by the degree of novelty (Rowley et al., 2011; Chang et al., 2012; Souto, 2015; Geldes et al., 2017a). However, studies have conceptualized Latin American innovation types according to the OECD Oslo Manual (OECD/Eurostat, 2005), which classifies innovation types into four categories (process, product, marketing and organizational) (Schmidt and Rammer, 2007; Geldes and Felzensztein, 2013). This typology has been empirically validated by Mothe and Nguyen-Thi (2012) for manufacturing firms in Luxembourg. In case of Latin America, there are studies related to these types of innovation, e.g., Geldes et al. (2015) explain determinants of inter-firm marketing cooperation as a kind of non-technological innovation stemming from proximity. Pino et al. (2016) analyze the relationship between non-technological innovation and market performance of exporting firms, while Geldes et al. (2017a) analyze the relationship of technological and non-technological innovation with performance and propensity to innovate. Thus, strategic innovation represents an important driver of a company's performance and must be developed as an integral part of the business strategy (Gunday et al., 2011). Empirically, a study of companies in Turkey concluded that the relationship between innovation and performance is positive and significant (Ar and Birdogan, 2011). In general, the relationship between innovation types and performance is positive and has a greater influence on the operational and financial performance (productivity and quality) (Yam et al., 2004; Saunila, 2014; Ar and Birdogan, 2011; Abu and Ahmad, 2010).

***H6: Innovation types (product/process/organization/marketing) are positively related to performance (Financial/Production/Market).***

The literature supports the mediating role of various innovation types in the relationship between internal and external factors, and performance. Previous studies analyzed cooperative innovation and institutional factors, with Crepon et al. (1998) stating that investments in R&D affected firm productivity through process innovation. Similarly, Bogliacino and Pianta (2013) discuss innovative strategies, such as seeking technological competitiveness through new product development and cost competitiveness through process innovation and technology acquisitions. Moving from one-way relationships to a system that accounts for simultaneous and combined effects, with full consideration of lags and feedbacks. Previous studies have analyzed factors such as innovation cooperation and institutional factors. In particular, Chadee and Roxas (2013) demonstrated that innovation has strong mediating effects on the institution-performance relationship of firms in Russia. From the perspective of cooperation, innovation mediates entrepreneurial success through cooperation with suppliers and research institutions (Najib and Kiminami, 2011; Tu et al., 2014). Mediation effects connect a relationship between predictors (antecedents of innovation) and business performance. Thus, the following hypothesis is proposed:

***H7: Innovation types have a mediating role on the antecedent factors of innovation and performance (Financial/Production/Market).***

Innovative activity faces numerous obstacles in the implementation stage. Barriers to innovation may be internal or external (Leal-Rodríguez et al., 2014). Assink (2006) presents a conceptual model that identifies clusters of barriers, including risk, uncertainty, lack of creativity, excessive bureaucracy and their influence on disruptive innovation at large firms. These problems block innovation financing (Bhattacharya and Ritter, 1983). In this regard, Mohnen et al. (2008) examined the effects of financial constraints on the decision to abandon, prematurely stop, slow or withdraw the start of an innovative project and believe that financial constraints also indirectly

reinforce other obstacles. The existence of financial constraints to innovation are typically investigated to determine the sensitivity of investment and R&D decisions (Mohnen et al., 2008, Bogliacino et al., 2009). Similar studies, such as D' Este et al. (2014), analyze the role of human capital in decreasing barriers to engage in innovation. Nevertheless, the authors believe that there are limitations with regard to several effects that may hide omitted variable biases. Thus, the following hypothesis is proposed:

***H8: Financial barriers have a moderating role in the relationship between innovation types and performance (Financial/Production/Market).***

All hypotheses are presented in a structural model in Figure 1.

--- Insert Figure 1 ---

### **3.- Methodology**

We aim to verify whether antecedent factors, internal resources for innovation and external factors, such as cooperation, information sources, institutional factors and the industry effect, have significant simultaneous effects on the innovation types used at companies. The empirical data set to verify the hypotheses from the national innovation survey manufacturing sectors in Peru and Chile. A structural equation model is proposed (Figure 1) that reflects the mediating role of innovation types.

An empirical study has been conducted regarding the economies of Peru and Chile. In accordance with recommendations by Becheikh et al. (2006), we have developed two separate structural models, including one model for each country (Hoyle, 2012). These models are estimated to separate determinants of innovation by location. Furthermore, national innovation surveys were used for manufacturing companies in both countries. In Peru, the data from the INEI (National



Institute of Statistics and Information) covered 1,144 companies in the manufacturing sector in 2011, representing approximately 85% of the total value added of manufacturing. The total value added is estimated via its relationship with the revenue of firms, included in the study, by applying a scaling factor computed from the value added of the entire country's manufacturing sector. In case of Peru, the value added is 85%, a figure close to 90% obtained in a survey. For Chile, the data were collected by the INE (Statistics National Institute) and consist of 1247 manufacturing companies in 2012, which represent approximately 70% of the total value added of manufacturing.

Following the correction of the observations for outliers and missing values, 970 suitable observations were obtained for Peru and 992 observations were obtained for Chile. Table 1 indicates that 30% of companies in the manufacturing sector in Chile introduce technological innovation compared with only 16% in Peru. However, the proportion of firms that make non-technological innovations in both countries is similar, Chile (25%) and Peru (18%). In this sense, Chile exhibits progress in transitioning to technological innovation, which is reflected in the finding of expenditure on innovation activities, including R&D internal (37%), R&D external (28%) and machinery acquisition (27%). However, Peru continues to concentrate its expenditure on machinery acquisition (78%) with minimal attention on R&D internal (3%) and R&D external (2%). In terms of human resources, the proportions of workers with bachelor's degrees include Peru (12%) and Chile (13%), whereas the workers with postgraduate studies include Peru (2%) and Chile (1%). An increased proportion of firms maintain cooperative relationships with universities and public or private research institutes in Peru (27%) compared with Chile (8%). However, we cannot draw concrete conclusions regarding this point because the quality of cooperation is not determined.

Based on these stylized facts, we aim to determine the paths to innovation using structural equation modeling. For example, if the implementation of R&D activates technological innovations in Chile, it is expected that performance dimensions of the firms will be improved. Similarly, the implementation of cooperation agreements between companies in Peru suggests that innovation will be activated to improve dimensions of performance.

--- Insert Table 1 ---

### ***3.1 Definition of variables***

The incorporation of the concepts of the Bogotá Manual in the manual of Oslo 2005 version enables the consideration of technological innovation in a more comprehensive manner, such as in the case of developing economies, including the concept of “technological effort” or “innovating activity”. Based on this concept, the following resources and capabilities of the company are defined as follows: organizational innovation; technology adoption; knowledge absorption capacities associated with the accumulation of local capacities; and training capacities (Crespi and Peirano, 2007).

In our model, we consider innovation activities, such as investment in R&D, as well as external and internal knowledge transfer, key resources in the innovation process in Latin America. Investments in internal R&D enable the company to increase the absorption and exploitation of external technology acquired (Crespi and Zuniga, 2012). Furthermore, in our model, the variable training capacity in both countries (Peru and Chile) exhibited a significant ( $p < 0.0$ ) relationship with innovation activities (R&D, as well as external and internal knowledge transfer); this finding implied that R&D efforts and training increase the technological capabilities of the innovative company. Therefore, we argue that the training capacity is included in the innovation activities as a type of technological effort, which induces further accumulation of technological capabilities

(Abereijo et al., 2007; Crespi and Zuniga, 2012; OECD/Eurostat, 2005). The absorptive capacity is the ability to detect and apply new knowledge to drive innovation activities, which enables the company to maintain a competitive advantage (Jiménez et al., 2011). In our model, we consider the activities of internal and external R&D, workers dedicated to innovation activities and the use of technical publications and patent databases, which are related to the absorptive capacity. Similarly, the absorptive capacity determines the innovative effort (Nieto and Quevedo, 2005).

We operationalized the variables of the structural model described in the previous section. Table 2 contains a detailed summary of the size of each variable. It is important to note that in the structural model presented in Figure 1, there are four latent variables (arranged in a circle): institutional factors, sources of information, production performance and market performance. In the case of Peru, an additional latent variable is included: export performance. The remaining variables are considered observable and have different natures (numerical and dichotomous).

Prior to model estimation, an exploratory and confirmatory factor analysis is applied. This approach is used to recognize the construction of latent variables. Standardized oblique rotations were applied according to the revised methodology of Hair et al. (2009). The results of the factor analysis are presented in Tables 3 and 4 for Chile and Peru, respectively.

--- Insert Table 2, Table 3, Table 4 ---

In summary, the factor analysis indicates good levels of reliability. The convergent validity included factor loads ( $> 0.5$ ), average variance extracted ( $AVE > 0.5$ ) and reliability of the construct ( $CR > 0.7$ ). For the discriminant validity,  $AVE > MSV$  (Maximum Shared Square Variance) and  $AVE > ASV$  (Average Shared Square Variance). A structural equation model (SEM) was developed to analyze the relationship between the antecedents of innovation and business

performance. The SEM follows the recommendations by Hair et al. (2009), Byrne (2010), Hoyle (2012), West et al. (2012). Specifically, the chi-square test and different indicators were considered with their level of minimum fit and good fit, respectively: i)  $\chi^2/df$  ratio ( $2 < x < 5$ ;  $x < 2$ ); ii) CFI (0.90); and iii) RMSEA ( $0.05 < x < 0.08$ ;  $x < 0.05$ ). Therefore, the fit indices suggest that the causal model fits the data fairly well and does a good job of explaining the relationships among the latent variables and observed variables (Zeng et al., 2010). Table 6 indicates the model fit in both structural models (Peru and Chile).

### **3.2 Group analysis**

Following the validation of the structural model, we perform a group analysis to evaluate potential changes in the relations of the structural model (Koufteros and Marcoulides, 2006; Hayes, 2013). To investigate variations in the relationships of innovation processes, the analysis variables by group include financial barriers, size, source of capital (Becheikh et al., 2006), and patenting level (Dosi, 1988).

Furthermore, the model was applied to industrial metallic and nonmetallic sectors, as recommended by the INE (National Institute of Statistics of Chile), based on ISIC divisions (International Standard Industrial Classification) (INE, 2014, 2017). Accomplish this purpose cluster analysis for both countries was performed (Peru and Chile) to define the most similar observations in the groups, according to the characteristics: types of innovation, R&D, industrial classification and firm size (Archibugi, 2001; Forero-Pineda et al., 2011). The non-metallic sector for Peru was represented by the sample: 120 (11%) from the manufacture of food product industry and 43 (4%) from the beverage industry; the metallic sector is represented by the sample: 106 (9%) from the manufacture of basic metals, 53 (5%) fabricated of metal products, with the exception of machinery and equipment; 18 (2%) manufacture of computer, electronic and optical products; and 55 (5%) manufacture of electrical equipment industry (Appendix A2). Furthermore, in the same vein as

Peru, we perform a cluster analysis for Chile and determine that the non-metallic sector was represented from the sample: 267 (21%) manufacture of food products and beverage industry and 103 (8%) from the manufacture of textiles, leather industry, and tobacco products; the metallic sector is represented from the sample: 125 (10%) from the Manufacture of fabricated metal products, with the exception of machinery and equipment and 121 (10%) from the manufacture of machinery (Appendix A3).

To determine the validity of the proposed model, we test the coefficient invariance across the groups, using the command *estat ginvariant* of the statistical software package STATA 13.1. This approach enables us to take the coefficients calculated for each group and apply a Score test and a Wald test to determine whether the coefficients are the same in both groups (Wooldridge, 2010).

### **3.3 Treatment of the control variables**

To analyze the degree of representativeness of the model, we evaluated the direct effect of the control variables (Hayes, 2013), source of capital, size, age, metallic and non-metallic (Becheikh et al., 2006).

## **4.- Results**

Table 5 indicates that in the case of Peru, the institutional factor has a negative effect on product and organizational innovation because the literature suggests that the institutional quality is low as a result of the following factors: Low levels of political commitment and public resources, lack of efficient structures and mechanisms, institutional inertia, poor system of monitoring and private investment (OECD, 2011); in the case of Chile, public programs generate a positive effect as public support to business R&D and innovation (OECD, 2012). Thus, hypotheses **H1a,b are not rejected**. Cooperation has a positive effect on innovation types, which is not true in the case of Chile; thus, hypothesis **H2 is partially accepted**. The sources of information influence the innovation types in Peru and Chile; thus, hypothesis **H3 is not rejected**. It is determined that internal resources for

innovation have a strong impact on innovation types in Peru and Chile; thus, hypothesis **H4 is not rejected**. Moreover, the industry effect has an impact on marketing and organizational innovation in Peru with no impact in Chile; thus, hypothesis **H5 is partially accepted**.

--- Insert Table 5 ---

Table 6 indicates that there is a positive and significant effect between innovation and performance in both Peru and Chile. These findings are consistent with previous research (Hall and Bagchi-Sen, 2002). Table 6 indicates that innovation types affect the performance indicators of enterprises in both Peru and Chile; thus, hypothesis **H6 is not rejected**.

--- Insert Table 6 ---

The mediating role of innovation types is evaluated to complete the analysis of robustness. Following Baron and Kenny (1986), we estimate the direct and indirect effects to determine whether innovation types act as mediators for antecedent variables of innovation types. The analysis results for mediation in Peru demonstrated that industry effects are partially mediated by innovation types and affect market performance. Specifically, 14% of the total effect is mediated by marketing and organizational innovations. Similarly, 23% of the total effect of cooperation on market performance is mediated by marketing and organizational innovations. Simultaneously, cooperation affects export performance by mediating organizational innovation. This effect accounts for 17% of the total effect. The results for Chile indicate no effects of complete or partial mediation; thus, hypothesis **H7 is partially accepted**. In Table 7, it is possible to obtain an explanation to recognize the significant paths of the determinants and consequences of the innovation types that managers may implement. For example, in Chile, we recognize that if firms implement R&D, process innovation is activated, and positive results are generated for product and market performance. Another significant path in Chile and Peru is through R&D and the industry

effect (Market dominated), which activates marketing innovation and has subsequent positive effects on market performance. In Peru, we identified determinants that companies may implement, including internal factors, such as R&D and industry effects, or external factors, such as cooperation and information sources, to activate organizational innovation, which has a positive effect on every dimension of performance (Financial, production, market and export). Both countries share paths in marketing innovation; nevertheless, Chile was an early bloomer in comparative terms with respect to the development of institutions to promote science and technology (Nelson, 2007; Schwellnus, 2010). This enabled it to gain an advantage compared with other countries in Latin America and particularly Peru. Thus, Chile has generated paths for technological innovation (process innovation), whereas Peru remains in the non-technological innovation development stage (relative to organizational and marketing innovation), which must be completed prior to embarking on technological innovations (Gunday et al., 2011).

--- Insert Table 7 ---

#### **4.1 Results of group analysis**

The National Innovation Survey data provide a richer characterization of the perceived barriers in Peru and Chile. We consider two groups for analysis: firms with a high perception of financial barriers and firms with a low perception of financial barriers (Bogliacino et al., 2009; Becheikh et al., 2006). Firms in the manufacturing sector in each country perceive financial barriers differently. The results for Peru, which are presented in Table 8, indicate that marketing innovation has a positive effect on companies that have a low perception of financial barriers as obstacles to innovation. In Table 9, the results for Chile indicate that process innovation has positive effects on market performance for companies with a low perception of financial barriers. Furthermore,

marketing innovation has a positive effect on product performance when companies have a high perception of financial barriers; thus, hypothesis **H8 is not rejected**.

--- Insert Table 8 ---

--- Insert Table 9 ---

Furthermore, Tables 10 to 16 indicate the results of the variable analysis by Group (size, level of patenting, source of capital and metallic and non-metallic sector). According to the sizes large and SME (small and medium enterprises), the results for Peru, as presented in Table 10, indicate that public programs have a negative effect on process innovation for large firms. Furthermore, the percentage of university workers has a positive effect on marketing innovation in micro and small firms. In Table 11, the results for Chile indicate that human capital has positive effects on product and marketing innovation, and support system has negative effects on marketing innovation for SME firms. However, public programs have a positive effect on product innovation for large firms.

--- Insert Table 10 ---

--- Insert Table 11 ---

According to the level of patenting (high and low), the results for Peru, as presented in Table 12, indicate that in high patent sectors, the percentage of non-university workers has a negative effect on process innovation; however, the percentage of workers dedicated to innovation activities has a positive effect on process innovation. Moreover, organizational innovation has a positive effect on export performance. In Table 13, the results for Chile indicate that in high patent sectors, the percentages of workers dedicated to innovation activities and public programs have positive effects on organizational innovation.

--- Insert Table 12 ---

--- Insert Table 13 ---



According to the source of capital, the results are only presented for Peru because of the insufficient sample for Chile. Table 14 indicates that support system has positive effects on product and organizational innovation in firms with foreign capital; however, for firms with domestic capital, support system has negative effects on product and organizational innovation.

--- Insert Table 14 ---

According to the sector (metallic and non-metallic), the results for Peru, which are presented in Table 15, indicate that support system has a negative effect on product innovation in the metallic sector (cluster 2); moreover, in the non-metallic sector (cluster 1), the percentage of not-university workers has a positive effect on financial performance. In Table 16, the results for Chile in the metallic sector (cluster 2) indicate that the percentages of workers dedicated to innovation activities and bachelor workers have positive effects on technological innovation. Furthermore, in the metallic sector (cluster 2), cooperation has a negative effect on organizational innovation; in the non-metallic sector (cluster 1), cooperation has a positive effect on marketing innovation.

--- Insert Table 15 ---

--- Insert Table 16 ---

#### **4.2 Results of the control variables**

To assess the structural model validity, we determine the competitive fit of the model considering the control variables (source of capital, metallic and non-metallic sectors), which indicates that the model without the control variables performs better than with the control variables because it is a parsimonious model (Byrne, 2010; Hayes, 2013). The fit indices of the structural model of Peru and Chile suggest that the model with control variables (source of capital and metallic and non-metallic sectors) did not improve the goodness of fit of the initial model, refer to Appendix A1, for the  $\chi^2$  /df ratio, RMSEA, and CFI (Hayes, 2013). Furthermore, Appendix A1 indicates that in the case of Chile, only the variable source of capital has a significant effect on performance; for Peru,

the variable size, age, and sector (metallic and non-metallic) have significant effects on performance.

## **5.- Discussion, implications and limitations**

As a result of the comparison of the two structural models by country, we identify specific paths of innovation for companies in Peru and Chile (Table 7). In the case of Peru, the driver to connect external and internal resources with performance is non-technological innovation. In Chile, the driver is technological innovation, as manufacturing companies invest more in R&D than those in Peru, at 37% and 3%, respectively; moreover, according to the World Intellectual Property Organization (WIPO, 2017), the average number of patent grants in Chile was 3 times that in Peru between 2009 and 2014.

The analysis by groups indicated the behavior of a company facing financial barriers. In the case of Chile, companies with high perceived financial constraints prefer to develop resources of innovation and marketing innovations to substantially improve product performance. In contrast, if the company has a low perception of financial constraints, then the company prefers to develop resources of innovation to upgrade process innovation to significantly improve market performance. In the case of Peru, there is no moderator effect because the financial barriers that companies face are decreased compared with Chile, which is consistent with the results of the Global Innovation Index for the previous three years. The behavior of companies that face financial barriers is attributable to the knowledge that the cost and risk of innovation is high (Bhattacharya and Ritter, 1983, Mohnen et al., 2008). Furthermore, non-technological innovation reduces cost and risk more than technological innovation.

In the case of Peru, public programs in large firms have negative effects on product innovation because of the low levels of political commitment, ineffective mechanisms and institutional inertia, in which policies are made that do not have the desired effects on innovation; moreover, high

bureaucratic procedures are a factor. For example, in Peru, it takes 26 days to start a business, whereas only 7 days are required in Chile (World Bank, 2012). Furthermore, large firms invest in R&D to perform non-technological innovation because they have more economic resources compared with small firms. Moreover, as a result of the lack of financial resources to invest in R&D, small firms hire university workers to perform activities of marketing with priority to social networks as a way to reach customers (Harris and Rae, 2009).

In the case of Chile, public programs maintain the positive effect on product innovation for large firms as a result of the high level of political stability and absence of violence/terrorism, in which Chile is ranked 37 and Peru is ranked 111. Moreover, in terms of Government effectiveness, Chile is ranked 26, whereas Peru is ranked 81 (Cornell University, INSEAD and WIPO, 2017), which provides an adequate environment to encourage innovation. Finally, in both countries, investment in R&D has positive effects on non-technological innovation.

According to the level of patenting (high and low), the results for Peru indicate that firms with high levels of patenting improve their export performance when process and organizational innovation are combined (Crespi and Zuniga, 2012). The results for Chile were similar between the two groups (low and high levels of patenting), and what stands out is that the percentage of workers dedicated to innovation activities increases innovation (Olavarrieta and Villena, 2014). As to Peruvian companies with domestic capital, the effect of the support system on product and organizational innovation is negative due to the scarcity of qualified personnel (Crespi and Zuniga, 2012; Olavarrieta and Villena, 2014). This is a relevant point because the individual dimension of capacity to absorb knowledge is related to the firm's innovative strategy, especially given the assimilation of external knowledge involved in exploration (Enkel et al., 2017). However, the effect of support system on product and organizational innovation is positive in companies with the participation of foreign capital because these firms may overcome the lack of support systems and

institutional voids and thus increase the propensity to invest in innovation activities (Crespi and Zuniga, 2012) and influence the most innovative activity (Álvarez and García, 2012).

With respect to the metallic and non-metallic sectors, in the case of the Peru non-metallic sector (cluster 1) in Table 15, the percentage of non-university workers has a positive effect on financial performance because food and beverage represent 19% of the total workers with secondary and non-university (Ministerio de la Producción, 2013, pp.70). However, in the metallic industry (cluster 2), support system has a negative effect on product innovation because of the scarcity of qualified personnel, an obstacle that most frequently occurs in the Manufacturing of basic metals (Ministerio de la Producción, 2013, pp.54).

In the case of the Chile non-metallic sector (cluster 1) in Table 16, cooperation has a positive effect on marketing innovation because in firms such as food and beverage packaging, it is the main determinant of product appearance (OECD/Eurostat, 2005, pp.60-61). However, in firms of the metallic sector (cluster 2), cooperation has a negative effect on organizational innovation, which may be a result of previous negative experiences (Geldes et al., 2015; Geldes et al., 2017b) and the low level of social capital characteristic of Chile (Legatum Institute, 2015). Furthermore, companies cooperate in innovation informally, with a focus on adapting technology (Geldes and Felzensztein, 2013; Malaver and Pérez, 2004). In the metallic sector (cluster 2), companies are oriented to innovation in product and process. A summary of the analysis by groups indicates that there are different routes in metal and non-metallic firms in the innovation process, which are influenced by internal and external factors to the companies; this finding is consistent with previous research at the level of the manufacturing industry, in which distinct strategies of technological and cost competitiveness use different inputs and drive a country's industries along contrasting trajectories (Bogliacino and Pianta, 2013). Furthermore, we demonstrated that the various routes are consistent with the previous literature presented.

This study recognizes that the challenge Latin American companies currently face involves focusing on development of resources and internal capabilities (Brenes et al. 2016). It is important to note that only specific types of resources activate the respective innovation types and that, in turn, only specific innovation types lead to improvements in manufacturing that enhance financial results. Our results indicate that the implementation of internal factors, such as R&D, activate process innovation and affect product performance. Furthermore, the implementation of external factors, such as cooperation, information sources and industry effects, activate organizational innovation and have a positive impact on performance. Finally, the combination of internal and external factors, such as R&D and the industry, effectively activates marketing innovation and has a positive effect on market performance (Table 7). This is relevant from a theoretical and practical perspective and will enable managers to configure the internal resources and strategic capabilities to implement innovation strategies that contemplate the specific dynamic contexts where companies operate.

### ***Implications to theory***

The proposed theoretical model addresses the need for a comprehensive model, grouping multiple variables and helping understand the innovation strategies at the firm's level (Chang et al., 2012). Specifically, the model contributes to understanding of how different factors affect simultaneously, directly or indirectly, the innovation process of firms (Chadee and Roxas, 2013; Yen, 2013; Becheikh et al., 2006). Additionally, the results state that the interaction between external and internal factors of firms is specific to each economic sector and country in emerging economies. Specifically, in the analyzed countries the factors relevant to the innovation process include resources available for innovation, cooperation among firms, and sources of innovation. Moreover, non-technological innovations are relevant to emerging economies. Finally, our results contribute to the development of a theoretical perspective on emerging economies.

In emerging economies, where customers are price sensitive and demand greater satisfaction of their needs, firms adapt resources and capabilities to the dynamic external environment to remain competitive by balancing exploration and exploitation activities (Derbyshire, 2014; Milesi et al., 2013; O'Reilly, & Tushman, 2013). Therefore, firms faced with this decision can adopt three strategic foci. The strategies may include, first, exploration through innovation in product and process and, second, exploitation through innovation in marketing or organizational structure. Third, both strategies (exploration and exploitation) may be combined towards development of ambidextrous capabilities to allow the company to outperform.

The summary of our study's results allows us to contribute to explaining how the firm adopts a certain innovation strategy, taking into account the firm's external and internal variables in emerging economies, as firms have different processes, each needing specific resources (Salerno et al., 2015). We observe that small firms prefer to develop non-technological innovations, following the exploitation strategy, in environments with weak institutional support and a lack of resources and skills to develop innovations that could impact the market. Additionally, such firms are faced with greater financial constraints, therefore, due to a lack of resources they focus on satisfying consumers' tangible needs while compensating for the lack of resources through cooperation.

Firms that engage primarily in technological innovation (i.e., following the exploration strategy) are those in environments with good institutional support, that tend to seek patents, are large and have personnel trained in R&D innovations.

The third type of firms, combining strategies of technological and non-technological innovation (i.e., exploration and exploitation, respectively), are large companies influenced primarily by

foreign capital, that compete in industries with large numbers of price-sensitive consumers (e.g., non-metallic industries) and organize themselves internally to be ambidextrous (Derbyshire, 2014).

### ***Practical Implications***

The most significant implication for managers and business management practice is possibly that only general recommendations for fostering innovation can be made at enterprise and sector levels, as external and internal factors affect innovation in ways, specific to each industrial sector and country (Luo, Sun, and Wang, 2011; Geldes et al., 2017a). The crucial determinants further vary between technological and non-technological innovation (Mothe and Nguyen-Thi, 2012; Geldes and Felzensztein, 2013). Within the scope of general recommendations, the key elements for promoting innovation at sector and enterprise levels involve resources dedicated to innovation, cooperation among businesses and improved access to information. Furthermore, it is important for managers to emphasize the value of non-technological innovations, due to their impact on business performance.

According to the preceding strategy overview, ambidextrous firms tend to outperform others, especially in emerging economies (Derbyshire, 2014). Correspondingly, managers should develop the capacity to combine exploration (i.e., technological innovation) and exploitation (i.e., non-technological innovation). In environments of low institutional quality, managers must combine appropriately the firm's internal resources and capacities with external resources (e.g., foreign capital and cooperation) to overcome institutional weaknesses. In favorable institutional environments, firms are apt to be ambidextrous without a greater reliance on external cooperation.

### ***Policy Implications***

The results and conclusions support the need for policies and programs aimed at promoting innovation, while considering specific features of each country and economic sector. The primary

reason is the differing levels of development of institutional factors (Peng et al., 2009; Zhu et al., 2012). Determinants of innovation, both internal and external, vary with economic sector (Geldes et al., 2017a). Moreover, developing specific programs for promoting each innovation type is recommended, especially in the often-ignored area of non-technological innovation.

The quality of institutions plays an important role in the development of firms' ambidextrous capabilities. Therefore, the innovation support system and institutional quality must encourage firms to combine both exploration and exploitation strategies through joint development of complementary technological and non-technological innovations.

### *Limitations*

First, our results are limited to the study of comparisons in innovation processes for manufacturing companies of Chile and Peru, with consideration of the representative factors that influence the innovation process at the level of manufacturing firms (Crespi and Zuniga, 2012). Extension to other emerging economies must be previously validated. This limitation leads to a series of new research opportunities to investigate our model in other countries with developed national innovation surveys, such as Mexico, Colombia, Argentina, Brazil and Venezuela (Crespi and Peirano, 2007), as well as other Latin American countries.

Second, the secondary sources of information used for both countries shed light only on four constructs (latent). Therefore, future research should consider the development and validation of new quantitative scales to assess model robustness (Becheikh et al., 2006). Furthermore, it is necessary to test model robustness in different types of sectors or territories or with other variables that studies have demonstrated to be important in the generation of innovation (Geldes and Felzensztein, 2013, Geldes et al., 2015, Pino et al., 2016; Geldes et al., 2017a), such as the evaluation of models for businesses that export and businesses that do not export and the assessment of the effect of belonging to a specific economic sector.



The third potential limitation is due to cluster analysis of the perceived financial barriers. However, it is possible to extend the analysis to include barriers in access to information and cultural factors. As to institutional barriers, according to a World Bank survey covering 135 countries, the main barriers in Peru and Chile are attributable to labor regulations, the degree of informality of each sector, corruption and insecurity (OECD/Eurostat, 2005; Vassolo, Julio O. De Castro, and Gomez-Mejia, 2011 ).

## **6.- Conclusions and future research**

This work contributes to the state of the art with a theoretical, structural model of the innovation process in emerging economies. Furthermore, empirical validation is performed to determine the drivers of innovation in Latin America. The results of the structural model indicate a strong connection between three antecedents to innovation: resources for innovation, cooperation and information sources. In both countries, resources and internal capabilities have significant and positive effects on all innovation types. Based on these internal capabilities, companies must develop a minimal level of capacity to innovate (Martínez-Román et al. 2011; Chang et al., 2012, Santos et al., 2014; Becheikh et al., 2006) and take advantage of sources of information (Morales and Sifontes, 2014, Bala Subrahmanya, 2013). In Peru, the effect of information sources is significant and generates an impact on organizational, process and product innovation. In Chile, the effect occurs only in product innovation (Bas et al., 2008). In contrast to the case of Peru, cooperation in the manufacturing sector of Chile has no significant effect. This result is attributable to the finding that business innovation is determined by internal factors that are specific to each industrial sector and country (Luo, Sun, and Wang, 2011, Becheikh et al., 2006). According to the results of the Global Innovation Index 2015 (Cornell University, INSEAD, and WIPO, 2015), Chile scores high on regulatory quality and exhibits a positive effect for institutional factors through

public programs that support innovation. By contrast, Peru had low scores for the same aspect, and its institutional barriers were demonstrated to have negative effects on innovation types. Different effects are generated by external elements, such as cooperation and institutional factors in each country. This is explained by the path-dependence of Chile and Peru (Perello-Marin et al., 2013). The finding that Chile had a head start in the creation of institutions that promote innovation (Nelson, 2007; Schwellnus, 2010) has enabled it to generate programs that support rather than impede innovation. In this context, cooperation may not be necessary. Another result of the structural model is that the industry effect is maintained in both countries (Zhu et al., 2012). A market structure in which one company dominates positively affects innovation in marketing. Moreover, innovation types have a positive and significant impact on the objective performance of a company; notwithstanding, non-technological innovations have a more substantial impact compared with technological innovations. This conclusion indicates that non-technological innovation creates a platform for the successful implementation of other levels of technological innovation (Bastic and Leskovar-Spacapan, 2006; Geldes et al., 2017a; Gunday et al., 2011; Kunc, 2007).

#### *Future research*

The cross-sectional nature of research into any dynamic aspect of a firm enables analysis of firms' conditions at only one specific point in time, rather than over a period of time. For instance, the firms' dynamics and the influence of technology collaboration networks are affected by macroeconomic cycles, the industry life cycle and the firm's age (Fernández-Olmos and Ramírez-Alesón, 2017). Future research should focus on a longitudinal study or perform analyses using a nonrecursive structural model, which demonstrates that the firm's financial results also influence its resources and capabilities (Bogliacino and Pianta, 2013) and that the model of system dynamics applies to the innovation process (Bas and Kunc, 2009; Gary et al., 2008; Samara et al., 2012).

Finally, we believe that the conclusions of the theoretical model proposed, and its empirical validation open the door to investigate the characteristics that lead formal firms to prefer specific paths of innovation when face with informal sector (unregistered firms) most important business development constraint in emerging markets (Vassolo, Julio O. De Castro, and Gomez-Mejia, 2011). Another relevant question is whether innovation paths change through temporal dimensions and which internal or external factors lead firms to choose specific innovation paths (Becheikh et al., 2006).

## **7.- References**

Abereiyo, I. O., Ilori, M. O., Taiwo, K. A. and Adegbite, S.A., 2007. Assessment of the capabilities for innovation by small and medium industry in Nigeria. *African Journal of Business Management* 1, 209–217. <http://www.academicjournals.org/AJBM>

Abu, L. J. and Ahmad, H., 2010. Assessing the relationship between firm resources and product innovation performance. *Business Process Management Journal* 16 (3):420-435. doi: <http://dx.doi.org/10.1108/14637151011049430>.

Álvarez, E. and García, W., 2012. Determinantes de la Innovación: Evidencia en el Sector Manufacturero de Bogota. *Semestre Económico* 15(32):129–160. <http://revistas.udem.edu.co/index.php/economico/article/view/398/356>

Amara, N., Landry R., Halilem, N. & Traore, N., 2010. Patterns of Innovation Capabilities in KIBS Firms: Evidence from the 2003 Statistics Canada Innovation Survey on Services. *Industry & Innovation* 17 (2):163-192. doi:10.1080/13662711003633371.

Ar, I. M. and Birdogan, B., 2011. Antecedents and performance impacts of product versus process innovation. *European Journal of Innovation Management* 14 (2):172-206. doi: <http://dx.doi.org/10.1108/14601061111124885>.

Archibugi, D., 2001. Pavitt's taxonomy sixteen years on: a review article. *Economics of Innovation and New Technology* 10 (5):415-425. <https://doi.org/10.1080/10438590100000016>

Assink, Marnix. 2006. "Inhibitors of disruptive innovation capability: a conceptual model." *European Journal of Innovation Management* 9 (2):215-233. <https://doi.org/10.1108/14601060610663587>

Bala Subrahmanya, M. H., 2013. External support, innovation and economic performance: what firm level factors matter for high-tech SMEs? How? *International Journal of Innovation Management* 17 (5): 1. doi: 10.1142/S1363919613500242.

Bas, T., Amoros, E. & Kunc, M., 2008. Innovation, entrepreneurship and clusters in Latin America natural resource: implication and future challenges. *Journal of Technology Management & Innovation* 3 (4): 52-65. <http://dx.doi.org/10.4067/S0718-27242008000200005>

Bas, T. & Kunc, M., 2009. National systems of innovations and natural resources clusters: evidence from copper mining industry patents. *European Planning Studies* 17 (12): 1861-1879. <https://doi.org/10.1080/09654310903322363>

Becheikh, N., Landry R. & Amara, N., 2006. Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993–2003. *Technovation* 26 (5): 644-664. <https://doi.org/10.1016/j.technovation.2005.06.016>

Bogliacino, F., Perani, G., Pianta, M. & Supino, S., 2012. Innovation and development: The evidence from innovation surveys. *Latin American Business Review* Vol. 13, Issue 3. <https://doi.org/10.1080/10978526.2012.730023>

Bogliacino, F. & Pianta, M., 2013. Profits, R&D, and innovation - a model and a test. *Industrial and Corporate Change* 22 (3): 649-678. <https://doi.org/10.1093/icc/dts028>

Bogliacino, F., Lucchese, M., Nascia, L. & Pianta, M., 2015. The Virtuous Circle of Innovation in Italian Firms. *Documentos FCE-CID, Escuela de Economía* N° 56. <http://dx.doi.org/10.2139/ssrn.2579641>

Baron, R. M. and Kenny, D. A., 1986. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology* 51 (6):1173. <http://dx.doi.org/10.1037/0022-3514.51.6.1173>

Bastic, M. and Leskovar-Spacapan, G., 2006. What do transition organizations lack to be innovative? *Kybernetes* 35 (7/8): 972-992. doi: <http://dx.doi.org/10.1108/03684920610675030>.

Bhattacharya, S. and Ritter, J. R., 1983. Innovation and Communication: Signalling with Partial Disclosure. *The Review of Economic Studies* 50 (2):331-346. <http://www.jstor.org/stable/2297419>

Brenes, E., Camacho, A., Ciravegna, L. and Pichardo C. A., 2016. Strategy and innovation in emerging economies after the end of the commodity boom – Insights from Latin America. *Journal of Business Research*. Vol. 69, Issue 10: 4363-4367. <https://doi.org/10.1016/j.jbusres.2016.03.059>

Byrne, B.M., 2010. Structural Equation Modeling with AMOS, Structural Equation Modeling. doi:10.4324/9781410600219

Catozzella, A. and Vivarelli, M., 2014. The Catalysing Role of In-House R&D in Fostering Complementarity Among Innovative Inputs. *Industry & Innovation* 21 (3):179-196. doi: 10.1080/13662716.2014.910890.

Chadee, D. and Roxas, B., 2013. Institutional environment, innovation capacity and firm performance in Russia. *Critical Perspectives on International Business* 9 (1/2):19-39. doi: <http://dx.doi.org/10.1108/17422041311299923>.

Chang, Y. C., Chang, H. T., Chi H. R., Chen M. H. and Deng, L. L., 2012. How do established firms improve radical innovation performance? The organizational capabilities view. *Technovation* 32 (7–8):441–451. doi: <http://dx.doi.org/10.1016/j.technovation.2012.03.001>.

Cohen, W. M. & Klepper, S., 1996. A reprise of size & R&D. *The Economic Journal* Vol. 106, N° 437 :925-951. DOI: 10.2307/2235365

CONCYTEC, 2013. Memoria 2012-2013. CONCYTEC nuevos tiempos para la CTI. Consejo Nacional de Ciencia, Tecnología e Innovación Tecnológica, Perú. 94 p.

Cooke, P., 2008. Regional Innovation Systems, Clean Technology & Jacobian Cluster-Platform Policies. *Regional Science Policy & Practice* 1 (1): 23–45. doi:10.1111/j.1757-7802.2008.00002.x

CORFO, 2013. Memoria Corfo 2010-2013. Corporación de Fomento de la Producción. Ministerio de Economía, Fomento y Producción, Chile. 140 p.

Crepon, B., Duguet, E. and Mairessec, J., 1998. Research, Innovation And Productivity: An Econometric Analysis At The Firm Level, *Economics of Innovation and New Technology*. doi:10.1080/10438599800000031.

Crespi, G. & Peirano, F., 2007. Measuring Innovation in Latin America : What we did , where we are and what we want to do. In: *Conference on Micro Evidence on Innovation in Developing Countries*, UNU-MERIT, Maastrich, The Netherlands. pp. 2–43.

Crespi, G., Zuniga, P., 2012. Innovation and Productivity: Evidence from Six Latin American Countries. *World Development*. 40(2): 273–290. doi:10.1016/j.worlddev.2011.07.010.

Cornell University, INSEAD, and WIPO. 2015. The Global Innovation Index 2015: Effective Innovation Policies for Development. Fontainebleau, Ithaca, and Geneva. In: [<https://www.globalinnovationindex.org/>] [october, 2017]

Crossan, M. M. & Apaydin, M., 2010. A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature. *Journal of Management Studies* 47 (6):1154-1191. doi: 10.1111/j.1467-6486.2009.00880.x.

Damapour, F., Walker, R. & Avellaneda, C., 2009. Combinative effects of innovation types and organizational performance: A longitudinal study of service organizations. *Journal of Management Studies* 46 (4), 650-675. doi:10.1111/j.1467-6486.2008.00814.x

de Faria, P., Lima, F. and Santos, R., 2010. Cooperation in innovation activities: The importance of partners. *Research Policy* 39 (8):1082-1092. doi: <http://dx.doi.org/10.1016/j.respol.2010.05.003>.

Derbyshire, J., 2014. The impact of ambidexterity on enterprise performance: Evidence from 15 countries and 14 sectors. *Technovation* 34 (10):574–581. doi:10.1016/j.technovation.2014.05.010

D'Este, P., Rentocchini, F. and Vega-Jurado, J. 2014. The Role of Human Capital in Lowering the Barriers to Engaging in Innovation: Evidence from the Spanish Innovation Survey. *Industry & Innovation* 21 (1):1-19. doi: 10.1080/13662716.2014.879252.

Dosi, G., 1988. Sources, procedures, and microeconomic effects of innovation. *Journal of economic literature* Vol 26 (3): 1120-1171. <http://www.jstor.org/stable/2726526>

Enkel, E., Heil, S., Hengstler, M. and Wirth, H., 2017. Exploratory and exploitative innovation: To what extent do the dimensions of individual level absorptive capacity contribute? *Technovation* 60-161: 29-38. <https://doi.org/10.1016/j.technovation.2016.08.002>

Feldens, M. A., Maccari E. A. and Garcez, M. P. 2012. Barriers for production innovation in small and medium technology-based firms in Brazil. *Brazilian Business Review (English Edition)* 9 (3): 1-22. DOI:<http://dx.doi.org/10.15728/bbr.2012.9.3.1>

Feldman, M. & Kogler, D., 2010. Stylized facts in the geography of innovation. In B. H. Hall & N. Rosenbergs (Eds.) *The Handbook of Economics of Innovation*. Vol. 1 (pp. 381-410). Amsterdam: North-Holland Publications, Elsevier. [https://doi.org/10.1016/S0169-7218\(10\)01008-7](https://doi.org/10.1016/S0169-7218(10)01008-7)

Fernández-Olmos, M. and Ramírez-Alesón, M., 2017. How internal and external factors influence the dynamics of SME technology collaboration networks over time. *Technovation* 64-65: 16-27. <https://doi.org/10.1016/j.technovation.2017.06.002>

Forero-Pineda, C., Laureiro-Martinez, D., Marín, A., 2011. Innovation patterns and intellectual property in SMEs of a developing country. *Innovar* 21(42) 113–128. [http://www.scielo.org.co/scielo.php?script=sci\\_arttext&pid=S0121-50512011000400010](http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0121-50512011000400010)

Gary, M. S., Kunc, M., Morecroft, J. & Rockart, S. F., 2008. System dynamics and strategy. *System Dynamics Review* 24 (4): 407- 429. doi:10.1002/sdr.402

Geldes, C. and Felzensztein, C., 2013. Marketing innovations in the agribusiness sector/Innovación en marketing en el sector de agronegocios. *Academia Revista Latinoamericana de Administración* 26 (1):108-138. <https://doi.org/10.1108/ARLA-05-2013-0042>

Geldes, C., Felzensztein, C., Turkina, E. and Durand, A., 2015. How does proximity affect interfirm marketing cooperation? A study of an agribusiness cluster. *Journal of Business Research* 68 (2): 263-272. doi: <http://dx.doi.org/10.1016/j.jbusres.2014.09.034>.

Geldes, C., Felzensztein, C. & Palacios, J., 2017a. Technological and non-technological innovations, performance and propensity to innovate across industries. The case of an emerging economy. *Industrial Marketing Management* 61, 55-66. <https://doi.org/10.1016/j.indmarman.2016.10.010>

Geldes, C., Heredia, J., Felzensztein, C. & Mora, M., 2017b. Proximity as determinant of business cooperation for technological and non-technological innovations: a study of an agribusiness cluster. *Journal of Business & Industrial Marketing*, 32 (1): 167-178. <https://doi.org/10.1108/JBIM-01-2016-0003>

Grimpe, C. and Hussinger, K., 2013. Formal and Informal Knowledge and Technology Transfer from Academia to Industry: Complementarity Effects and Innovation Performance. *Industry & Innovation* 20 (8):683-700. doi: 10.1080/13662716.2013.856620.

Guarascio, D., Pianta, M., Lucchese, M. & Bogliacino, F., 2015. Business cycles, technology and exports. *Economia Politica*, 32 (2): 167-200. <https://doi.org/10.1007/s4088>

Gunday, G., Ulusoy, G., Kilic, K. and Alpkan, L. 2011. Effects of innovation types on firm performance. *International Journal of Production Economics* 133 (2):662-676. doi: <http://dx.doi.org/10.1016/j.ijpe.2011.05.014>.

Hair, J. F., Black W. C., Babin B. J., and Anderson, R. A., 2009. *Multivariate Data Analysis*. Pearson Prentice Hall.

Hall, L. A. and Bagchi-Sen, S., 2002. A study of R&D, innovation, and business performance in the Canadian biotechnology industry. *Technovation* 22 (4):231-244. [https://doi.org/10.1016/S0166-4972\(01\)00016-5](https://doi.org/10.1016/S0166-4972(01)00016-5)

Harris, L. and Rae, A., 2009. Social networks: the future of marketing for small business. *Journal of Business Strategy* 30(5): 24–31. doi:10.1108/02756660910987581

Hayes, A. F. 2013. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*: Guilford Press.

Hoyle, R., 2012. Model specification in structural equation modelling. *Handbook of structural equation modelling*. Hoyle Ed. The Guilford Press, New York – London, pp. 126-144.

INE, 2014. CIIU4.CL. Clasificador chileno de actividades económicas. Instituto Nacional de Estadísticas de Chile, 440 p.

INE, 2016. Sectores económicos Chile. Boletín Sectores Económicos. Instituto Nacional de Estadísticas de Chile. In [<http://www.ine.cl/estadisticas/economicas/manufactura>] [october, 2017].

Jiménez, M., García, V., Molina, L.M., 2011. Validation of an instrument to measure absorptive capacity. *Technovation* 31(5) 190–202. doi:10.1016/j.technovation.2010.12.002.

Kazakov, R. & Kunc, M., 2016. Foreseeing the Dynamics of Strategy: An Anticipatory Systems Perspective. *Systemic Practice and Action Research*, 29 (1):1-25. doi: 10.1007/s11213-015-9349-0.

Ketelhöhn, N. & Ogliastri, E., 2013. Introduction: innovation in Latin America/Introducción: innovación en América Latina. *Academia Revista Latinoamericana de Administración*, 26 (1): 12-32. <https://doi.org/10.1108/ARLA-05-2013-0037>

Koufteros, X., Marcoulides, G.A., 2006. "Product development practices and performance: A structural equation modeling-based multi-group analysis". *International Journal of Production Economics* 103(1): 286–307. doi:10.1016/j.ijpe.2005.08.004.

Kühl, M. R. and da Cunha, J. C., 2013. Obstacles to implementation of innovations in Brazil: how different companies perceive their importance. *Brazilian Business Review* 10 (2):1-24. <http://dx.doi.org/10.15728/bbr.2013.10.2.1>

Kunc, Martin H. 2007. "A survey of managerial practices in the small to medium Chilean wineries." *Journal of Wine Research* 18 (2):113-119. <https://doi.org/10.1080/09571260701660888>

Lazonick, W., 2006. The innovative firm. In J. Fegerberg, D. C. Mowery, & R. R. Nelson (Eds). *The Oxford handbook of innovation* (pp. 29-55). Oxford: Oxford University Press. DOI: 10.1093/oxfordhb/9780199286805.003.0002

Lawson, B. and Samson, D., 2001. Developing Innovation Capability in Organisations: A Dynamic Capabilities Approach. *International Journal of Innovation Management* 5 (3):377. <https://doi.org/10.1142/S1363919601000427>

Leal-Rodríguez, A. L., Ariza-Montes J. A., Roldán J. L. and Leal-Millán, A. G., 2014. Absorptive capacity, innovation and cultural barriers: A conditional mediation model. *Journal of Business Research* 67 (5):763-768. doi: <http://dx.doi.org/10.1016/j.jbusres.2013.11.041>

Legatum Institute, 2015. The Legatum Prosperity Index. In: [<https://lif.blob.core.windows.net/lif/docs/default-source/publications/2015-legatum-prosperity-index-pdf.pdf?sfvrsn=2>] [august, 2016].

Luo, Y., Sun, J. and Lu Wang, S., 2011. Comparative strategic management: An emergent field in international management. *Journal of International Management* 17 (3):190-200. <https://doi.org/10.1016/j.intman.2011.05.002>

Malaver, F. and Pérez, M., 2004. Los procesos de innovación en la industria colombiana: resultados de un estudio de casos. *Cuadernos de Administración* 17, 9–51.

Martínez-Román, J. A., Gamero, J. and Tamayo, J. A. 2011. Analysis of innovation in SMEs using an innovative capability-based non-linear model: A study in the province of Seville (Spain). *Technovation* 31 (9):459-475. doi: <http://dx.doi.org/10.1016/j.technovation.2011.05.005>.

McCann, P. & Ortega-Argilés, R., 2015. Smart specialization, regional growth and applications to European Union Cohesion Policy. *Regional Studies*, Vol. 49, Issue 8, 1291-1302. <https://doi.org/10.1080/00343404.2013.799769>



Meyer, K. E, & Peng, M. W., 2015. Theoretical foundations of emerging economy business research. *Journal of International Business Studies*, 47 (1): 3-22. <https://doi.org/10.1057/jibs.2015.34>

Milesi, D., Petelski, N., Verre, V., 2013. Innovation and appropriation mechanisms: Evidence from Argentine microdata. *Technovation* 33 (2-3):78–87. doi:10.1016/j.technovation.2012.12.001

Ministerio del Trabajo y Previsión Social, 2017. Minuta de Empleo Nacional. Unidad de Estudios Laborales. Subsecretaria de Estudios Laborales. Ministerio del Trabajo y Previsión Social, Chile. In: [<http://www.subtrab.trabajo.gob.cl/programas-de-empleo/cifras-de-empleo/>] [october, 2017]

Ministerio del Trabajo y Promoción del Empleo, 2017. Anuario Estadístico Sectorial 2016. Ministerio del Trabajo y Promoción del Empleo, Perú. 390 p.

Ministerio de la Producción, 2013. Encuesta Nacional de Innovación en la Industria Manufacturera 2012. In [<http://www.perucam.com/descargas/EncuestaNacional.pdf>] [november, 2015].

Mohnen, P., Palm F. C., Schim van der Loeff S. and Tiwari, A., 2008. Financial Constraints and Other Obstacles: are they a Threat to Innovation Activity? *De Economist* 156 (2):201-214. doi: <http://dx.doi.org/10.1007/s10645-008-9089-y>.

Morales R. M. and Sifontes, D. A., 2014. Patents and R&D cooperation in Latin America. *Investigación & Desarrollo* 22 (1). [http://www.scielo.org.co/scielo.php?script=sci\\_arttext&pid=S0121-32612014000100002](http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0121-32612014000100002)

Mothe, C. & Nguyen-Thi, T., 2012. Non-technological and technological innovations: Do services differ from manufacturing? An empirical analysis of Luxembourg firms. *International Journal of Technology Management* 57 (4): 227-244. <https://doi.org/10.1504/IJTM.2012.045544>

Nieto, M., & Quevedo, P., 2005. Absorptive capacity, technological opportunity, knowledge spillovers, and innovative effort. *Technovation*, 25(10): 1141–1157. <https://doi.org/10.1016/j.technovation.2004.05.001>

Najib, M. and Kiminami, A., 2011. Innovation, cooperation and business performance: Some evidence from Indonesian small food processing cluster. *Journal of Agribusiness in Developing and Emerging Economies* 1 (1): 75-96. <https://doi.org/10.1108/20440831111131523>

Nelson, R.R., Winter, S.G., 1982. "An Evolutionary Theory of Economic Change". Belknap Press.

Nelson, R. C. 2007. Transnational Strategic Networks and Policymaking in Chile: CORFO's High Technology Investment Promotion Program. *Latin American Politics and Society* 49 (2):149-181. DOI: 10.1111/j.1548-2456.2007.tb00410.x

Nieto, M. J. and Santamaría, L. 2010. Technological Collaboration: Bridging the Innovation Gap between Small and Large Firms. *Journal of Small Business Management* 48 (1):44-69. DOI: 10.1111/j.1540-627X.2009.00286.x

OECD/Eurostat., 2005. Oslo Manual. Proposed Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition. OECD, Paris.

OECD. 2011. OECD Reviews of Innovation Policy: Peru 2011: OECD Publishing.

OECD. 2012. OECD Science, Technology and Industry Outlook 2012: OECD Publishing.

Olavarrieta, S., Villena, M.G., 2014. Innovation and business research in Latin America: An overview. *Journal of Business Research*, 67(4): 489–497. <https://doi.org/10.1016/j.jbusres.2013.11.005>

O'Reilly, C. A., & Tushman, M.L., 2013. Organizational Ambidexterity: Past, Present and Future. *The Academy of Management Perspectives* 27(4):324–338. doi:10.5465/amp.2013.0025

Pai, D.C., Tseng C. Y. and Liou, C. H. 2012. Collaborative innovation in emerging economies: Case of India and China. *Innovation: Management, Policy & Practice* 14 (3):467-476. <https://doi.org/10.5172/impp.2012.14.3.467>

Parnell, J. A., 2002. A business strategy typology for the new economy: reconceptualization and synthesis. *Journal of Behavioral and Applied Management*, 3 (3):206-226.

Parnell, J. A., 2011. Strategic capabilities, competitive strategy, and performance among retailers in Argentina, Peru and the United States. *Management Decision*, 49 (1):139-155. <https://doi.org/10.1108/00251741111094482>

Pavitt, K., 1984. Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy* 13(6): 343–373. doi:10.1016/0048-7333(84)90018-0

Pavitt, K., 2006. Innovation Processes. In J. Fegerberg, D. C. Mowery, & R. R. Nelson (Eds). *The Oxford handbook of innovation* (pp. 86-114). Oxford: Oxford University Press. DOI:10.1093/oxfordhb/9780199286805.003.0004

Peng, M. W., Sun S. L, Pinkham B. and Chen, H. 2009. The Institution-Based View as a Third Leg for a Strategy Tripod. *Academy of Management Perspectives* 23 (3):63-81. doi: 10.2307/27747526.

Peng, M. W., Wang D. Y. L. and Jiang, Y., 2008. An institution-based view of international business strategy: a focus on emerging economies. *Journal of International Business Studies* 39 (5):920-936. doi: <http://dx.doi.org/10.1057/palgrave.jibs.8400377>.

Perello-Marin, M. R., Marin-Garcia J. A. and Marcos-Cuevas, J. 2013. Towards a path dependence approach to study management innovation. *Management Decision* 51 (5):1037-1046. doi: <http://dx.doi.org/10.1108/MD-08-2012-0605>.

Petrizzelli, M. A and Rotolo, D., 2015. Institutional diversity, internal search behaviour, and joint-innovations. *Management Decision* 53 (9):2088-2106. doi: 10.1108/MD-05-2014-0256.

Pino, C., Felzensztein, Ch., Zwerg-Villegas, A. M. & Arias-Bolzmann, L., 2016. Non-technological innovations: Market performance of exporting firms in South America. *Journal of Business Research*, Vol. 69, Issue 10, 4385-4393. <https://doi.org/10.1016/j.jbusres.2016.03.061>

Porter, M., 1998. Clusters and the New Economics of Competition. *Harvard Business Review* 76: 77-90.

Powell, T. C. 1996. Research notes and communications. How much does industry matter? An alternative empirical test. *Strategic Management Journal* 17 (4):323-334. <http://www.jstor.org/stable/2486954>

Ray, G., Barney, J. B. & Muhanna, W. A., 2004. Capabilities, business processes, and competitive advantage: choosing the dependent variable in empirical tests of the resource-based view. *Strategic Management Journal* 25 (1): 23-37. doi: 10.1002/smj.366.

Raymond, L. and St-Pierre, J., 2010. R&D as a determinant of innovation in manufacturing SMEs: An attempt at empirical clarification. *Technovation* 30 (1):48-56. doi: <http://dx.doi.org/10.1016/j.technovation.2009.05.005>.

RICYT, 2017. Indicadores Comparativos de Ciencia y Tecnología. Red de Indicadores de Ciencia y Tecnología Iberoamericana e Interamericana (RECYT). In: [[http://dev.ricyt.org/ui/v3/comparative.html?indicator=GAS\\_IMD\\_USDxH](http://dev.ricyt.org/ui/v3/comparative.html?indicator=GAS_IMD_USDxH)] [october, 2017]

Robinson, S. and Stubberud, H. A., 2011. Sources of information and cooperation for innovation in Norway. *Journal of International Business Research* 10 (2):91-102.

Rowley, J., Baregheh, A. & Sambrook, S., 2011. Towards an innovation-type mapping tool. *Management Decision* 49 (1): 73-86. <http://dx.doi.org/10.1108/00251741111094446>

Rumelt, Richard P., 1991. How much does industry matter? *Strategic management journal* 12 (3):167-185. <http://www.jstor.org/stable/2486591>

Salerno, M.S., de Vasconcelos Gomes, L.A., da Silva, D.O., Bagno, R.B., Freitas, S.L.T.U., 2015. Innovation processes: Which process for which project? *Technovation* 35, 59–70. doi:10.1016/j.technovation.2014.07.012

Samara, E., Georgiadis, P., Bakouros, I., 2012. The impact of innovation policies on the performance of national innovation systems: A system dynamics analysis. *Technovation* 32(11): 624–638. doi:10.1016/j.technovation.2012.06.002

Santos, D. F. L., Cruz, L. F., Kimura, H. and Kazuo E., 2014. Innovation efforts and performances of Brazilian firms. *Journal of Business Research* 67 (4):527-535. doi: <http://dx.doi.org/10.1016/j.jbusres.2013.11.009>.

Saunila, M., 2014. Innovation capability for SME success: perspectives of financial and operational performance. *Journal of Advances in Management Research* 11 (2):163. <https://doi.org/10.1108/JAMR-11-2013-0063>

Schendel, Dan, & Derek Channon., 1991. Why do firms differ, and how does it matter? *Strategic Management Journal* 12 (2):61-74. doi:10.1002/smj.4250121006

Schmidt, T. & Rammer, C., 2007. Non-technological and Technological Innovation: Strange Bedfellows? Discussion paper 07-052. ZEW, Centre for European Economic Research, 47.

Schwellnus, C., 2010. Chile: Boosting Productivity Growth by Strengthening Competition, Entrepreneurship and Innovation. OECD Economics Department Working Papers. 40 p.

Souto, J. E., 2015. Business model innovation and business concept innovation as the context of incremental innovation and radical innovation. *Tourism Management* 51:142-155. doi: <http://dx.doi.org/10.1016/j.tourman.2015.05.017>.

Stock, G. N., Greis, N. & Fischer, W.A., 2002. Firm size and dynamic technological innovation. *Technovation*, 22 (9): 537-549. [https://doi.org/10.1016/S0166-4972\(01\)00061-X](https://doi.org/10.1016/S0166-4972(01)00061-X)

Svensson, R., 2008. Innovation Performance and Government Financing. *Journal of Small Business and Entrepreneurship* 21 (1):95-110,112-116. <https://doi.org/10.1080/08276331.2008.10593415>

USPTO, 2014. Performance and Accountability Report. United State Patent and Trademark Office. In [<https://www.uspto.gov/>] [october, 2017].

Tavassoli, S. and Karlsson C., 2015. Persistence of Various Types of Innovation Analyzed and Explained. Lund University, CIRCLE-Center for Innovation, Research and Competences in the Learning Economy.

Tu, C., Hwang, S. N., and Wong, J. Y., 2014. How does cooperation affect innovation in micro-enterprises? *Management Decision* 52 (8):1390. <https://doi.org/10.1108/MD-07-2013-0388>

Vassolo, R. S., Julio O. De Castro, & Gomez-Mejia, L.R., 2011. Managing in Latin America: Common Issues and a Research Agenda. *Academy of Management Perspectives*. 25(4):22–36. doi:10.5465/amp.2011.0129

Venkatraman, N. & Ramanujam, V., 1986. Measurement of Business Performance in Strategy Research: A Comparison of Approaches. *The Academy of Management Review*, 11 (4): 801-814. <http://www.jstor.org/stable/258398>

West, S., Taylor, A. & Wu, W., 2012. Model fit and model selection in structural equation modelling. *Handbook of structural equation modelling*. Hoyle Ed. The Guilford Press, New York – London, pp. 209-231.

Wei, J. C., and Y. Liu. 2015. Government support and firm innovation performance Empirical analysis of 343 innovative enterprises in China. *Chinese management studies* 9 (1):38-55. doi: 10.1108/CMS-01-2015-0018.

Wooldridge, J.M., 2010. *Econometric Analysis of Cross Section and Panel Data*, The MIT Press. doi:10.1515/humr.2003.021

World Bank, 2012. *Doing Business, 2012*. World Bank. doi:10.1596/978-0-8213-8833-4.

World Bank, 2017. World Bank Open Data. In: [<http://data.worldbank.org>] [october, 2017].

World Intellectual Property Organization (WIPO), 2017. WIPO IP Statistics Data Center. In: [<http://ipstats.wipo.int/ipstatv2/index.htm?tab=patent>] [october, 2017].

Xiaorong, I., Xiaoxue, X. and Suicheng, L., 2013. Trust and Relationship Commitment. *Information Technology, Journal* 12 (17):4106-4113. <https://doi.org/10.1108/17506141011074129>

Yam, R. C. M., Cheng, J., Fai K. and Tang, Esther P., 2004. An audit of technological innovation capabilities in chinese firms: some empirical findings in Beijing, China. *Research Policy* 33 (8):1123-1140. doi: <http://dx.doi.org/10.1016/j.respol.2004.05.004>.

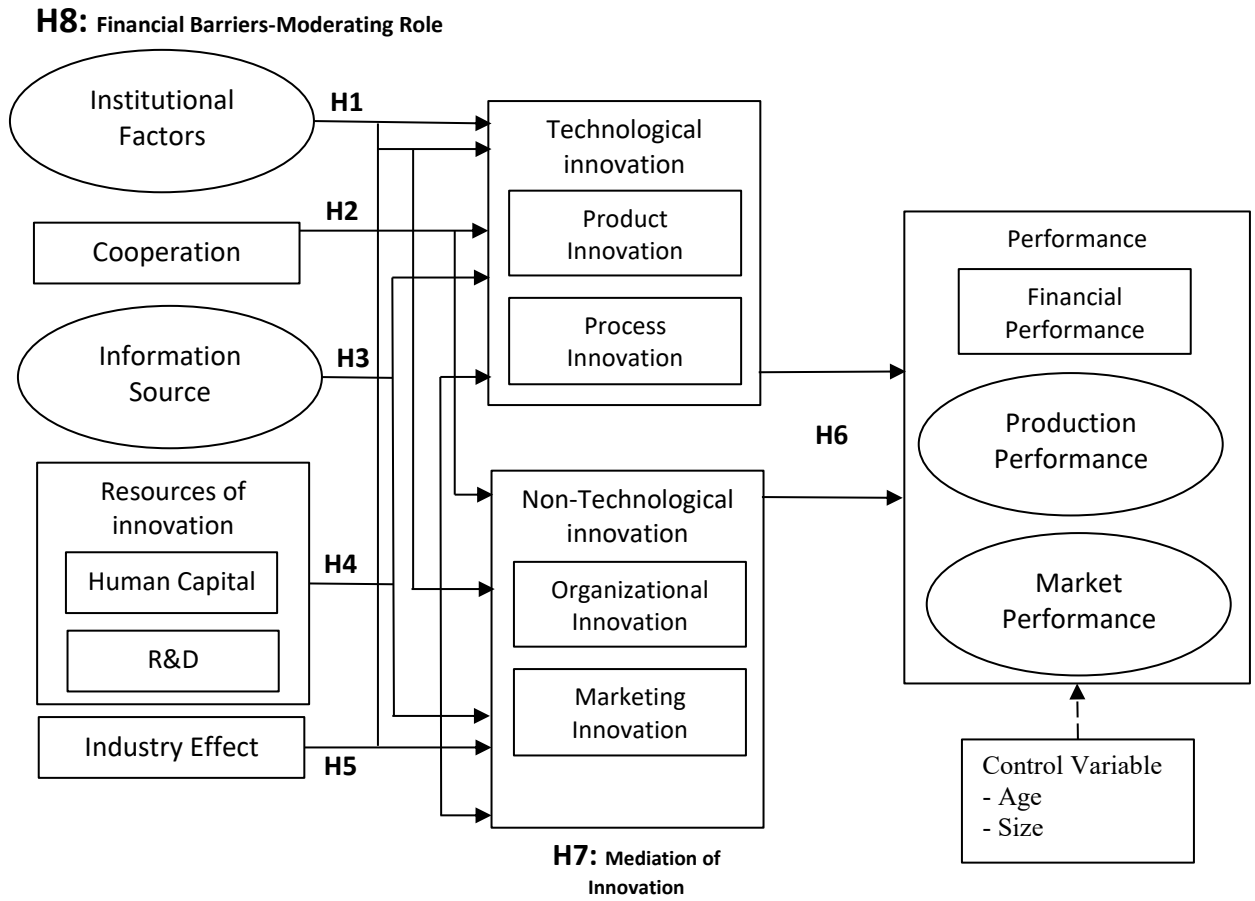
Yen, Y. F., 2013. The impact of bank's human capital on organizational performance: How innovation influences performance. *Innovation : Management, Policy & Practice* 15 (1):112-127. <https://doi.org/10.5172/impp.2013.15.1.112>

Yuqian, Han, and Li Dayuan. 2015. "Effects of intellectual capital on innovative performance." *Management Decision* 53 (1):40-56. doi: 10.1108/MD-08-2013-0411.

Zeng, S. X., X. M. Xie, and C. M. Tam. 2010. Relationship between cooperation networks and innovation performance of SMEs. *Technovation* 30 (3):181-194. doi: <http://dx.doi.org/10.1016/j.technovation.2009.08.003>.

Zhu, Y., Wittmann, X. & Peng, M. W., 2012. Institution-based barriers to innovation in SMEs in China. *Asia Pacific Journal of Management*, 29 (4):1131-1142. doi: <http://dx.doi.org/10.1007/s10490-011-9263-7>.

Figure 1. Proposed Model



Source: Own elaboration

Table 1: Descriptive statistics- Sample Peru (2011) Chile (2012)

	Peru	Chile
Number of observations	1144	1247
<b>Technological Innovation (as % of total firms):</b>	16.43%	30.23%
Product	4.20%	20.37%
Process	15.65%	24.46%
<b>Non-technological Innovation (as % of total firms):</b>	17.74%	24.94%
Marketing	8.65%	17.64%
Organization	13.37%	19.33%
<b>Total expenditure on innovation (as a % of total turnover)</b>	2.31%	1.47%
<b>Expenditure on innovation by type (as a % of total expenditure on innovation)</b>		
Machinery acquisition	77.83%	27.30%
R&D internal	2.98%	37.13%
R&D external	1.57%	27.89%
Share of firms that performed R&D internal	27.19%	14.43%
<b>Share of turnover from product innovations (as a % of total turnover)</b>	3.81%	3.75%
<b>Human Resource (as a % of total workers in sector)</b>		
Total workers with postgraduate	1.62%	0.72%
Total workers with bachelor	11.54%	13.29%
<b>Cooperation</b>		
Share of firms that co-operated with universities	15.21%	3.37%
Share of firms that co-operated with private research institute	8.22%	2.73%
Share of firms that co-operated with public research institute	3.85%	1.92%
<b>Public programs (Share of firms that received financial support and made innovation)</b>	24.73%	22.30%
<b>Total sales (MM-US dollar) /1</b>	40.15	72.50

/1. Exchange rate, 2.69 for Peru and 478.6 for Chile

Source: Innovation Survey's Peru and Chile

Own Elaboration

Table 2: Summary of variables and constructs

Category	Sub-Category(Country)	Item-Description	Variables and scales	References
Institutional Factors	Support System (Peru/Chile)/1	Innovation Obstacle: Scarcity of qualified personal	Ordinal (1-4)	(Peng, Wang, and Jiang, 2008, Peng et al., 2009, Zhu, Wittmann, and Peng, 2012)
		Innovation Obstacle: Not enough information on technologies		
		Innovation Obstacle: Not enough information on the market		
	Public Programs (Peru/Chile)	Do you know public programs to support innovation?	Dichotomous	( Peng, Wang, and Jiang, 2008, Peng et al., 2009, Zhu, Wittmann, and Peng, 2012)
Resources of Innovation <sup>1,2</sup>	Research & Development (Peru/Chile)	Acquisition R&D internal, external and knowledge transfer <sup>1</sup>	Dichotomous	(Crespi and Zuniga, 2012)
	Human Capital (Peru)	Percentage of workers with university degrees	Numerical (0-100)	
		Percentage of workers with non-university degree		
		Percentage of workers dedicated to innovation activities		
	Human Capital (Chile)	Percentage of workers with bachelor degrees		
		Percentage of workers with technical degrees		
		Percentage of workers dedicated to innovation activities <sup>2</sup>		
	Cooperation <sup>1,2</sup>	Cooperation (Peru/Chile)	Relationships with suppliers, customers and competitors, universities and research institutes	

<sup>1</sup> We are considering the innovation activities such as investment in R&D as well as external and internal knowledge transfer, key resources in the innovation process in Latin America (Crespi and Zuniga, 2012). Investments in internal R&D enable the company to increase the absorption and exploitation of external technology acquired (Crespi and Zuniga, 2012). Furthermore, the variable training capacity in both countries (Peru and Chile) exhibited significant ( $p < 0.0$ ) relationship with innovation activities (R&D as well as external and internal knowledge transfer). In the case of Peru, the parameters of the test of association of variables are: Pearson  $\chi^2(1) = 220.74$  Pr = 0.0, Cramér's V = 0.50, Fisher's exact = 0.0, whereas for Chile are: Pearson  $\chi^2(1) = 120.55$  Pr = 0.0, Cramér's V = 0.345, Fisher's exact = 0.0.

<sup>2</sup> Absorptive capacity it is the ability to detect and apply new knowledge to drive innovation activities, which enables the company to maintain competitive advantage (Jiménez et al., 2011). In our model, we are consider the activities of internal and external R&D, workers dedicated to innovation activities and the use of technical publications and patent databases, which are related to absorptive capacity (Nieto and Quevedo, 2005). Similarly absorptive capacity determines the innovative effort (Nieto and Quevedo, 2005).



<b>Source of Information</b> <sup>\1</sup>	(Peru/Chile)	Conferences, fairs and exhibitions.	Ordinal (1-4)	(Bala Subrahmanya, 2013, Morales and Sifontes, 2014)
		Scientific magazines, technical publications and patent databases		
		Industrial and professional associations		
<b>Industry Effects</b> <sup>\2</sup>	(Peru)	Detection of unsatisfied demand in the market?	Dichotomous	(Powell, 1996, Peng et al., 2009)
		Threat of competition?		
	(Peru/Chile)	Market dominated by established companies?	Ordinal (1-4)	(Becheikh, Landry, and Amara, 2006)
<b>Financial Barriers</b> <sup>\2</sup>	(Peru/Chile)	Lack of funds in the company or group of companies	Ordinal (1-4)	(Bhattacharya and Ritter, 1983, Assink, 2006, Leal-Rodríguez et al., 2014)
		Lack of funding sources outside the company		

<sup>\1</sup> this variable was modeled as a construct, <sup>\2</sup> this variable was modeled as observable.  
Source: Own elaboration.

Table 2: Summary of variables and constructs (continue).

Category	Sub-Category (Country)		Item-Description	Variables and scales	References
technological Innovation <sup>1,2</sup>	Product Innovation (Peru/Chile)		Good or service new or significantly improved	Dichotomous	(OECD/Eurostat, 2005, Ar and Birdogan, 2011, Chadee and Roxas, 2013)
	Process (Peru/Chile)	Innovation	Process new or significantly improved service		
Non-Technological Innovation <sup>1,2</sup>	Organizational Innovation (Peru/Chile)		New business practices, methods of work organization and methods of organizing external relations	Dichotomous	
	Marketing (Peru/Chile)	Innovation	Changes in product design or packaging (product), new media or marketing techniques, new methods of placement and new pricing methods		
Financial Performance <sup>1,2</sup>	Sales growth ( Peru/Chile)		Difference between sales between 2011 and 2012 (Chile), Difference between sales between 2009 and 2011 (Peru)	Numerical	(Najib and Kiminami, 2011, Chadee and Roxas, 2013)
Production Performance <sup>1</sup>	(Peru/Chile)		Impact: degree of importance of reducing labor costs	Ordinal (1-4)	(Gunday et al., 2011)
	(Chile)		Improve the quality of goods and services		
			Impact: degree of importance of reducing costs per unit produced		
			Impact: degree of importance of increasing productive capacity		
	(Peru)		Impact: degree of importance of reducing energy costs		
			Impact: degree of importance of reducing the cost of raw materials and inputs		
Market Performance <sup>1,2</sup>	(Peru)		Increase market share	Ordinal (1-4)	(Gunday et al., 2011)
			Maintain market share		
	(Chile)		Increasing or maintaining market share		
			Introduce new products or market segment		
			Introduce new products for a market based on geography		
Export Performance <sup>1,2</sup>	(Peru)		Allows to open new markets abroad	Ordinal (1-4)	(Gunday et al., 2011)
			Allows reaching international standards or regulations		

<sup>1</sup> this variable was modeled as a construct, <sup>2</sup> this variable was modeled as observable.

Source: Own elaboration.

Table 3: Tests of convergent and discriminant validity -Chile

Constructs and Items	Convergent Validity			Discriminant Validity	
	Factor Load	AVE	CR	MSV	ASV
Market Performance		0.43	0.68	0.07	0.03
Increasing or maintaining market share	0.46				
Introducing new products or market segment	0.91				
Introducing new products for a market based on geography	0.52				
Support System (Obstacle)		0.71	0.88	0.00	0.00
Scarcity of qualified personal	0.75				
Not enough information on technologies	0.93				
Not enough information on the market	0.83				
Source of Information		0.54	0.78	0.03	0.02
Conferences, fairs and exhibitions.	0.72				
Scientific magazines, technical publications and patent databases	0.83				
Industrial and professional associations	0.64				
Production Performance		0.51	0.74	0.07	0.03
Impact: degree of importance of reducing labor costs	0.72				
Improve the quality of goods and services	0.45				
Impact: degree of importance of reducing costs per unit produced	0.89				

Source : Own elaboration.

Table 4: Tests of convergent and discriminant validity-Peru

Constructs and Items	Convergent Validity			Discriminant Validity	
	Factor Load	AVE	CR	MSV	ASV
Market Performance		0.63	0.77	0.33	0.12
Increase market share	0.74				
Maintain market share	0.85				
Production Performance		0.44	0.80	0.33	0.17
Impact: degree of importance of reducing labor costs	0.74				
Impact: degree of importance of increasing productive capacity	0.59				
Impact: degree of importance of reducing energy costs	0.72				
Impact: degree of importance of reducing the cost of raw materials and inputs	0.65				
Impact: degree of importance of improving aspects of the health and/or safety environment	0.60				
Source of Information		0.54	0.78	0.12	0.08
Conferences, fairs and exhibitions.	0.73				
Scientific magazines, technical publications and patent databases	0.84				
Industrial and professional associations	0.61				
Export Performance		0.55	0.70	0.12	0.03
Allows to open new markets abroad	0.59				
Allows reaching international standards or regulations	0.87				
Support System (Obstacle)		0.55	0.79	0.02	0.01
Scarcity of qualified personal	0.64				
Not enough information on technologies	0.87				
Not enough information on the market	0.70				

Source : Own elaboration.

Table 5: Results for antecedent factors and innovation types Chile and Peru

Antecedent factors	Chile			
	Product Innovation	Process Innovation	Organizational Innovation	Marketing Innovation
<b>Institutional Factor</b>				
Support system				
Public Programs		0.06**		
<b>Cooperation</b>				
<b>Information Source</b>	0.10*			
<b>Resources of Innovation</b>				
Human capital	0.06*			
R&D	0.29*	0.22*	0.42*	0.19*
<b>Industry Effect</b>				
Market dominated				0.07**
Antecedent factors	Peru			
	Product Innovation	Process Innovation	Organizational Innovation	Marketing Innovation
<b>Institutional Factor</b>				
Support system	-0.11*		-0.11*	
Public Programs				
<b>Cooperation</b>	0.10*	0.11*	0.15*	
<b>Information Source</b>	0.09**	0.09**	0.12*	
<b>Resources of Innovation</b>				
Human capital				
R&D	0.12*	0.15*	0.17*	0.15*
<b>Industry Effect</b>				
Market dominated				0.13*
Unsatisfied demand in the market			0.08*	

(\*)Values shown correspond to a significance level of 5%, values with (\*\*) have significance level of 10%, non-significant values not shown.

Source: Own Elaboration.

Table 6: Results for innovation types and performance dimensions Chile and Peru

Innovation Types	Chile			
	Financial Performance	Production Performance	Market Performance	
Product Innovation				
Process Innovation		0.15*	0.11*	
Organizational Innovation				
Marketing Innovation			0.09*	

Innovation Types	Peru			
	Financial Performance	Production Performance	Market Performance	Export Performance
Product Innovation				
Process Innovation				
Organizational Innovation	0.08*	0.13*	0.15*	0.08**
Marketing Innovation			0.09*	

Goodness of fit Model Peru		CMIN/df	CFI	RMSEA
Model		2.5	0.891	0.039
Minimum		$2 < x < 5$	0.90	$x < 0.05$

Goodness of fit Model Chile		CMIN/df	CFI	RMSEA
Model		3.2	0.851	0.047
Minimum		$2 < x < 5$	0.90	$x < 0.05$

(\*)Values shown correspond to a significance level of 5%, values with (\*\*) have significance level of 10%, non-significant values not shown.

Source: Own Elaboration.

Table 7: Significant paths to innovation within company

Antecedents factors	Chile			
	Product Innovation	Process Innovation	Organizational Innovation	Marketing Innovation
<b>Cooperation</b>				
<b>Information Source</b>	X			
<b>Resources of Innovation</b>				
Human capital	X			
R&D	X	⊗	X	⊕
<b>Industry Effect</b>				
Market dominated				⊕
	Product Innovation	Process Innovation	Organizational Innovation	Marketing Innovation
<b>Financial Performance</b>				
<b>Production Performance</b>		⊗		
<b>Market Performance</b>		⊗		⊕
Antecedents factors	Peru			
	Product Innovation	Process Innovation	Organizational Innovation	Marketing Innovation
<b>Cooperation</b>	X	X	☆	
<b>Information Source</b>	X	X	☆	
<b>Resources of Innovation</b>				
Human capital				
R&D	X	X	☆	⊕
<b>Industry Effect</b>				
Market dominated				⊕
Unsatisfied demand in the market			☆	
	Product Innovation	Process Innovation	Organizational Innovation	Marketing Innovation
<b>Financial Performance</b>			☆	
<b>Production Performance</b>			☆	
<b>Market Performance</b>			☆	⊕
<b>Export Performance</b>			☆	

⊗ **Path 1:** Implement R&D activates process innovation and it has effects on market and production performance.

☆ **Path 2:** Implement cooperation, information source, R&D and industry effect activate organizational innovation and it has effects on performance.

⊕ **Path 3:** Implement R&D and industry effect activate marketing innovation and has effect on market performance.

Source: Own elaboration

Table 8: Test of invariance coefficients across groups, Peru

<b>Group: Financial Barriers - Wald Test<sup>1</sup></b>				
<b>Relationship</b>	<b>High</b>	<b>Low</b>	<b><math>\chi^2</math>- statistic</b>	<b>p-value</b>
Industry Effect: threat of competition?--> Marketing Innovation	0.10	-0.06	3.81	0.05
Marketing Innovation --> Production Performance	-0.13	0.10*	5.04	0.02
Resources of Innovation: R&D --> Process Innovation	0.15*	0.15*	0.09	0.76
Process Innovation --> Market Performance	0.15	0.02	1.53	0.22

Financial barriers was created from Likert scale variables, if firms chose that obstacle have none importance, it belong to the low group.

(\*) 5% individual significant level of coefficient by each group.

n.a means not available.

<sup>1</sup> The test evaluates the null hypothesis: The coefficients are the same in both groups, only the results reject the null hypothesis in both countries are presented, last column show p-value of test.

Source: Own elaboration

Table 9: Test of invariance coefficients across groups, Chile

<b>Group: Financial Barriers - Wald Test<sup>1</sup></b>				
<b>Relationship</b>	<b>High</b>	<b>Low</b>	<b><math>\chi^2</math>-statistic</b>	<b>p-value</b>
Industry Effect: threat of competition?--> Marketing Innovation	-	-	-	-
Marketing Innovation --> Production Performance	0.15*	-0.06	4.10	0.04
Resources of Innovation: R&D --> Process Innovation	0.17*	0.30*	9.47	0.00
Process Innovation --> Market Performance	-0.03	0.27*	4.24	0.04

Financial barriers was created from Likert scale variables, if firms chose that obstacle have none importance, it belong to the low group.

(\*) 5% individual significant level of coefficient by each group.

n.a means not available.

<sup>1</sup> The test evaluates the null hypothesis: The coefficients are the same in both groups, only the results reject the null hypothesis in both countries are presented, last column show p-value of test.

Source: Own elaboration



Table 10: Test of invariance coefficients across size group, Peru

<b>Group: Size - Wald Test<sup>1</sup></b>				
<b>Relationship</b>	<b>Large Firm</b>	<b>Mye Firm</b>	<b><math>\chi^2</math>-statistic</b>	<b>P-value</b>
Institutional factors: Public Programs --> Process Innovation	-0.16*	0.06	6.90	0.01
Institutional factors: Support System --> Process Innovation	-0.09	0.13	5.23	0.02
Institutional factors: Public Programs --> Product Innovation	0.06	-0.06	1.70	0.19
Human Capital: % workers dedicate to innovation activities --> Product Innovation	0.06	-0.02	0.81	0.37
Resources of Innovation: R&D --> Organizational Innovation	0.20*	0.16*	0.10	0.75
Human Capital: % workers dedicates to innovation activities --> Organizational Innovation	-0.04	0.00	0.19	0.66
Resources of Innovation: R&D --> Marketing Innovation	0.17*	0.13*	0.08	0.77
Human Capital: % University workers --> Marketing Innovation	-0.01	0.15*	2.80	0.09
Institutional factors: Support System --> Marketing Innovation	-0.12	-0.04	0.65	0.42

Size group was created from categorical variable. Then, firms chose its size, but we group medium and small firms into Mye firm group.

(\*) 5% individual significant level of coefficient by each group.

n.a means not available.

<sup>1</sup> The test evaluates the null hypothesis: The coefficients are the same in both groups, only the results reject the null hypothesis in both countries are presented, last column show p-value of test.

Source: Own elaboration

Table 11: Test of invariance coefficients across size group, Chile

Group: Size - Wald Test <sup>1</sup>				
Relationship	Large Firm	Mye Firm	$\chi^2$ -statistic	p-value
Institutional factors: Public Programs --> Process Innovation	0.08	0.02	1.02	0.31
Institutional factors: Support System --> Process Innovation	0.11	-0.09	5.89	0.02
Institutional factors: Public Programs --> Product Innovation	0.19*	-0.04	13.67	0.00
Human Capital: % workers dedicate to innovation activities --> Product Innovation	0.01	0.11*	4.13	0.04
Resources of Innovation: R&D --> Organizational Innovation	0.47*	0.38*	15.56	0.00
Human Capital: % workers dedicate to innovation activities --> Organizational Innovation	-0.07	0.06	4.25	0.04
Resources of Innovation: R&D --> Marketing Innovation	0.30*	0.10*	15.56	0.00
Human Capital: % Bachelor workers --> Marketing Innovation	-0.11	0.02*	4.75	0.03
Institutional factors: Support System --> Marketing Innovation	0.07	-0.11*	3.98	0.05

Size group was created from categorical variable. Then, firms chose its size, but we group medium and small firms into Mye firm group.

(\*) 5% individual significant level of coefficient by each group.

n.a means not available.

<sup>1</sup> The test evaluates the null hypothesis: The coefficients are the same in both groups, only the results reject the null hypothesis in both countries are presented, last column show p-value of test.

Source: Own elaboration

Table 12: Test of invariance coefficients across patent group, Peru

<b>Group: Patent - Wald Test<sup>1</sup></b>				
<b>Relationship</b>	<b>High patent sector</b>	<b>Low patent sector</b>	<b><math>\chi^2</math>-statistic</b>	<b>p-value</b>
Human Capital: % Non-University workers --> Process Innovation	-0.14*	0.06	5.60	0.02
Human Capital: % workers dedicate to innovation activities --> Process Innovation	0.11*	-0.07	4.30	0.04
Industry Effect: Threat of competition? --> Organizational Innovation	-0.09	0.07	3.97	0.05
Organizational Innovation --> Export Performance	0.17*	-0.02	3.80	0.05
Resources of Innovation: R&D --> Process Innovation	0.17*	0.14*	0.32	0.57
Institutional factors: Public Programs --> Organizational Innovation	-0.05	0.05	1.48	0.22
Resources of Innovation: R&D --> Organizational Innovation	0.18*	0.15*	0.17	0.68
Human Capital: % workers dedicate to innovation activities --> Organizational Innovation	0.00	0.04	0.25	0.62
Resources of Innovation: R&D --> Marketing Innovation	0.15	0.17	0.01	0.92

High patent group was created from percent of firms that use patent by subsector. We order subsectors from highest to lowest and group those that are above mean of manufacture sector like high patent sector.

(\*) 5% individual significant level of coefficient by each group.

n.a means not available.

<sup>1</sup> The test evaluates the null hypothesis: The coefficients are the same in both groups, only the results reject the null hypothesis in both countries are presented, last column show p-value of test.

Source: Own elaboration

Table 13: Test of invariance coefficients across patent group, Chile

<b>Group: Patent - Wald Test<sup>1</sup></b>				
<b>Relationship</b>	<b>High patent sector</b>	<b>Low patent sector</b>	<b><math>\chi^2</math>-statistic</b>	<b>p-value</b>
Human Capital: % Technical workers --> Process Innovation	0.03	-0.01	0.42	0.52
Human Capital: % workers dedicates to innovation activities --> Process Innovation	0.06	-0.04	1.43	0.23
Industry Effect: Threat of competition? --> Organizational Innovation	n.a.	n.a.	n.a.	n.a.
Organizational Innovation --> Export Performance	n.a.	n.a.	n.a.	n.a.
Resources of Innovation: R&D --> Process Innovation	-0.08	0.32*	51.56	0.00
Institutional factors: Public Programs --> Organizational Innovation	0.15*	-0.02	4.51	0.03
Resources of Innovation: R&D --> Organizational Innovation	0.24*	0.49*	24.77	0.00
Human Capital: % workers dedicate to innovation activities --> Organizational Innovation	0.12*	-0.04	4.56	0.03
Resources of Innovation: R&D --> Marketing Innovation	0.09	0.24	12.34	0.00

High patent group was created from percent of firms that use patent by subsector. We order subsectors from highest to lowest and group those that are above mean of manufacture sector like high patent sector.

(\*) 5% individual significant level of coefficient by each group.

n.a means not available.

<sup>1</sup> The test evaluates the null hypothesis: The coefficients are the same in both groups, only the results reject the null hypothesis in both countries are presented, last column show p-value of test.

Source: Own elaboration

Table 14: Test of invariance coefficients across capital source group, Peru

<b>Group: Capital Source - Wald Test<sup>1</sup></b>				
<b>Relationship</b>	<b>Capital Foreign</b>	<b>Capital domestic</b>	<b><math>\chi^2</math>-statistic</b>	<b>p-value</b>
Industry Effect: Market dominated --> Product Innovation	-0.22	0.08	4.54	0.03
Institutional factors: Support System --> Product Innovation	0.38*	-0.16*	13.79	0.00
Industry Effect: Market dominated --> Process Innovation	-0.33*	0.01	5.85	0.02
Industry Effect: Market dominated --> Marketing Innovation	-0.15	0.15*	4.43	0.04
Industry Effect: Market dominated --> Organizational Innovation	-0.29*	0.05	5.38	0.02
Institutional factors: Support System --> Organizational Innovation	0.36*	-0.16*	10.42	0.00
Product Innovation --> Financial Performance	-0.22	0.07	4.09	0.04
Process Innovation --> Market Performance	-0.21	0.07	3.91	0.05

Capital source was taken from the question whether the firm had share of foreign capital. Results for Chile can't be estimated because sample is too small.

(\*) 5% individual significant level of coefficient by each group.

n.a means not available.

<sup>1</sup> The test evaluates the null hypothesis: The coefficients are the same in both groups, only the results reject the null hypothesis in both countries are presented, last column show p-value of test.

Source: Own elaboration

Table 15: Test of invariance coefficients across Metallic and non-metallic sector (cluster groups), Peru.

Group: Cluster - Wald Test <sup>1</sup>					
Relationship		Cluster 1	Cluster2	$\chi^2$ -statistic	p-value
Cooperation----->	Product Innovation	n.a	n.a	n.a	n.a
Institutional factors: Support System----->	Product Innovation	-0.1	-0.69*	238.79	0
Human Capital: % workers dedicates to innovation activities----->	Product Innovation	n.a	n.a	n.a	n.a
Resources of Innovation: R&D ----->	Process Innovation	n.a	n.a	n.a	n.a
Human Capital: % Bachelor workers ----->	Process Innovation	n.a	n.a	n.a	n.a
Cooperation ----->	Organizational Innovation	n.a	n.a	n.a	n.a
Institutional factors: Public programs----->	Organizational Innovation	n.a	n.a	n.a	n.a
Resources of Innovation: R&D ----->	Organizational Innovation	n.a	n.a	n.a	n.a
Human Capital: % workers dedicates to innovation activities ----->	Organizational Innovation	n.a	n.a	n.a	n.a
Cooperation----->	Marketing Innovation	n.a	n.a	n.a	n.a
Institutional factors: Public programs----->	Marketing Innovation	n.a	n.a	n.a	n.a
Resources of Innovation: R&D ----->	Marketing Innovation	n.a	n.a	n.a	n.a
Institutional factors: Support System----->	Marketing Innovation	n.a	n.a	n.a	n.a
Process Innovation----->	Financial Performance	n.a	n.a	n.a	n.a
Human capital: % non-University workers----->	Financial Performance	0.33*	0.01	6.44	0.01
Age----->	Product Performance	n.a	n.a	n.a	n.a

Non-metallic (cluster 1): Manufacture of food products; beverages.

Metallic (cluster 2): Manufacture of basic metals, fabricated of metal products, except machinery and equipment; manufacture of computer, electronic and optical products; manufacture of electrical equipment

Cluster has been created from the type of innovation (product, process, organizational, marketing), resources of innovation (R&D), ISIC (International Standard Industrial Classification), revision.4 and size.

(\*) 5% individual significant level of coefficient by each group.

n.a means not available.

<sup>1</sup> The test evaluates the null hypothesis: The coefficients are the same in both groups, only the results reject the null hypothesis in both countries are presented, last column show p-value of test.

Source: Own elaboration

Table 16: Test of invariance coefficients across Metallic and non-metallic sector (cluster groups), Chile.

Group: Cluster - Wald Test <sup>1</sup>					
Relationship		Cluster 1	Cluster2	$\chi^2$ -statistic	p-value
Cooperation----->	Product Innovation	0.09	-0.13	4.43	0.04
Institutional factors: Support System----->	Product Innovation	n.a	n.a	n.a	n.a
Human Capital: % workers dedicate to innovation activities ----->	Product Innovation	0.06	0.29*	7.52	0.01
Resources of Innovation: R&D ----->	Process Innovation	0.25*	0.07	5.55	0.02
Human Capital: % Bachelor workers ----->	Process Innovation	-0.09	0.13*	5.16	0.02
Cooperation----->	Organizational Innovation	0.11	-0.14*	7.46	0.01
Institutional factors: Public programs ----->	Organizational Innovation	-0.04	0.18*	4.04	0.04
Resources of Innovation: R&D ----->	Organizational Innovation	0.49*	0.39*	8.32	0
Human Capital: % workers dedicate to innovation activities ----->	Organizational Innovation	-0.05	0.14	4.39	0.04
Cooperation----->	Marketing Innovation	0.16*	-0.06	7.46	0.01
Institutional factors: Public programs----->	Marketing Innovation	0.11*	-0.1	4.71	0.03
Resources of Innovation: R&D ----->	Marketing Innovation	0.33*	0.13	10.65	0
Institutional factors: Support System----->	Marketing Innovation	-0.11	0.13	4.18	0.04
Process Innovation----->	Financial Performance	0.07	-0.16	4.82	0.02
Human capital: % non-University workers----->	Financial Performance	n.a	n.a	n.a	n.a
Age----->	Product Performance	-0.24*	0.14	5.45	0.02

Non-metallic (cluster 1): Manufacture of food products; beverages; manufacture of textiles, leather and tobacco products.

Metallic (cluster 2): Manufacture of fabricated metal products, except machinery and equipment; Repair and installation of machinery and equipment.

Cluster has been created from the type of innovation (product, process, organizational, marketing), Resources of innovation (R&D), ISIC (International Standard Industrial Classification), revision 3 and size.

(\*) 5% individual significant level of coefficient by each group.

n.a means not available

<sup>1</sup>The test evaluates the null hypothesis: The coefficients are the same in both groups, only the results reject the null hypothesis in both countries are presented, last column show p-value of test

Source: Own elaboration

Appendix A1: Results for control variables and performance dimensions Chile and Peru.

Control Variable	Chile		
	Financial Performance	Production Performance	Market Performance
Source of capital	-0.06*		
Size			
Age			
Metallic and non-metallic			

Control Variable	Peru			
	Financial Performance	Production Performance	Market Performance	Export Performance
Source of capital				
Size	0.12*			0.24*
Age	-0.19*			
Metallic and non-metallic	0.08*	0.14*	0.11*	

Goodness of fit Model Peru	CMIN/df	CFI	RMSEA
Model	2.3	0.89	0.037
Minimum	$2 < x < 5$	0.90	$x < 0.05$
Goodness of fit Model Chile	CMIN/df	CFI	RMSEA
Model	3.0	0.85	0.045
Minimum	$2 < x < 5$	0.90	$x < 0.05$

Capital source was taken from the question if the firm had a foreign capital share.

The metallic and non-metallic sector in the case of Chile has been created based on ISIC (International Standard Industrial Classification), revision 3, grouped from 15 to 26 the non-metallic sector and 27 to 36 the metallic sector, whereas Peru has been created based on ISIC (International Standard Industrial Classification), revision 4 grouped from 10 to 23 the non-metallic sector and 24 to 33 the metallic sector

(\*) All values correspond to a significance level of 5%

Source: Own elaboration



Appendix A2. Sample size in each sector description of the sample of Peru according the ISIC (International Standard Industrial Classification), revision 4.

<b>Division</b>	<b>Description</b>	<b>Number of observations</b>	<b>% of total firms</b>
10	Manufacture of food products	120	11%
11	Manufacture of beverages	43	4%
13	Manufacture of textiles	50	4%
14	Manufacture of wearing apparel	54	5%
15	Manufacture of leather and related products	33	3%
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	49	4%
17	Manufacture of paper and paper products	46	4%
18	Printing and reproduction of recorded media	36	3%
19	Manufacture of coke and refined petroleum products	15	1%
20	Manufacture of chemicals and chemical products	57	5%
21	Manufacture of pharmaceuticals, medicinal chemical and botanical products of pharmaceutical use	30	3%
22	Manufacture of rubber and plastics products	59	5%
23	Manufacture of other non-metallic mineral products	99	9%
24	Manufacture of basic metals	106	9%
25	Manufacture of fabricated metal products, except machinery and equipment	53	5%
26	Manufacture of computer, electronic and optical products	18	2%
27	Manufacture of electrical equipment	55	5%
28	Manufacture of machinery and equipment n.e.c.	35	3%
29	Manufacture of motor vehicles, trailers and semi-trailers	48	4%
30	Manufacture of other transport equipment	24	2%
31	Manufacture of furniture	47	4%
32	Other manufacturing	46	4%
33	Repair and installation of machinery and equipment	25	2%
<b>Total Firms</b>		<b>1144</b>	<b>100%</b>

Source: INEI (National Institute of Statistics and Informatics), 2011.

Appendix A3. Sample size in each sector of the sample of Chile according the ISIC (International Standard Industrial Classification), revision 3.

Division	Description	Number of observations	% of total firms
15	Manufacture of food products and beverages	267	21%
16 <sup>1</sup>	Manufacture of textiles, leather and tobacco products	103	8%
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	91	7%
21	Manufacture of paper and paper products	63	5%
22 <sup>2</sup>	Others	166	13%
24	Manufacture of chemicals and chemical products	95	8%
27	Manufacture of basic metals	46	4%
28	Manufacture of fabricated metal products, except machinery and equipment	125	10%
29 <sup>3</sup>	Manufacture of machinery	121	10%
31	Manufacture of electrical machinery and apparatus n.e.c.	34	3%
33	Manufacture of medical, precision and optical instruments, watches and clocks	24	2%
34 <sup>4</sup>	Manufacture of motor vehicles and transport equipment	38	3%
36	Manufacture of furniture, manufacturing n.e.c.	74	6%
<b>Total Firms</b>		1247	100%

1: In this division has been considered the divisions: 16-17-18-19.

2: In this division has been considered the divisions: 22-23-25-26.

3: In this division has been considered the divisions: 29-30.

4: In this division has been considered the divisions: 34-35.

Source: INE (Statistics National Institute), 2012.